PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-109993
(43)Date of publication of application : 18.04.2000

(51)Int.Cl. C25D 1/04

(21)Application number : 11-182777
(22)Date of filing : 29.06.1999

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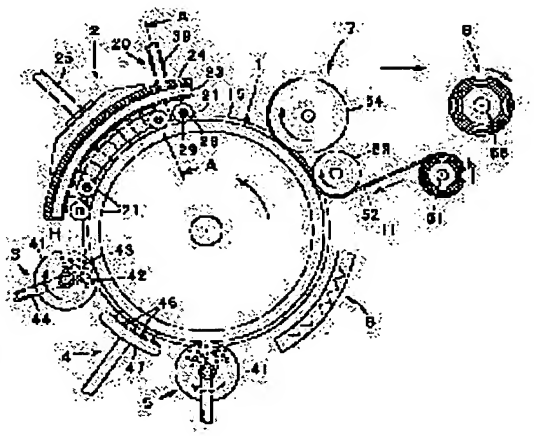
(30)Priority
Priority number : 10218832 Priority date : 03.08.1998 Priority country : JP

(54) DEVICE AND METHOD FOR PRODUCING METALLIC FOIL AND METALLIC FOIL PIECE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide the device and method capable of continuously and stably producing metallic foil and metallic foil pieces by simple equipment even in the case the metallic foil is a thin film.
SOLUTION: This device is provided with a plating soln. feeding means 20, via a plating roller 21 abutted on the outer circumferential face of a rotary drum 1 in which the outer circumferential face is made to be the negative electrode face, feeding a plating soln. to the outer circumferential face and a plating means 2, via the plating soln., electrically communicates with the outer circumferential face of the rotary drum 1 and electrolytically precipitating metallic foil into the outer circumferential face of the rotary drum 1. Moreover, a plating soln. cleaning means 4 for cleaning the plating soln. adhered to the metallic foil electrolytically precipitated into the outer circumferential face of the rotary drum 1, a drying means 4 for drying the metallic foil after the cleaning and a peeling means 7 for peeling the metallic foil after the drying from the outer circumferential face of the rotary drum 1 are provided. Moreover, in place of the peeling means 7, a brush roller which peels the metallic foil while it is parted is provided, by which metallic foil pieces can be produced.



LEGAL STATUS

[Date of request for examination]	29.06.1999
[Date of sending the examiner's decision of rejection]	
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	3076565
[Date of registration]	09.06.2000
[Number of appeal against examiner's decision of	

rejection]
[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right]

* NOTICES *

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2.**** shows the word which can not be translated.
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CLAIMS

[Claim(s)]
[Claim 1] The rotating drum with which it was supported free [rotation] and the peripheral face was made into the negative electrode side, and a plating liquid supply means to supply plating liquid to the peripheral face of said rotating drum, The plating means equipped with the positive electrode member which it flows [member] electrically with the peripheral face of said rotating drum through the plating liquid supplied from this plating liquid supply means, and carries out electrolytic deposition of the metallic foil to the peripheral face of said rotating drum, A plating liquid washing means to wash the plating liquid adhering to the metallic foil which it was prepared in the downstream of said plating means, and carried out electrolytic deposition to the peripheral face of said rotating drum to the hand of cut of said rotating drum, A desiccation means to dry the metallic foil which it was prepared in the downstream of said plating liquid washing means, and carried out electrolytic deposition to the peripheral face of said rotating drum to the hand of cut of said rotating drum, The manufacturing installation of a metallic foil which has an exfoliation means to exfoliate the metallic foil which it was prepared in the downstream of said desiccation means, and carried out electrolytic deposition to the peripheral face of said rotating drum to the hand of cut of said rotating drum from said peripheral face.
[Claim 2] Said plating liquid supply means is the manufacturing installation of the metallic foil indicated to claim 1 equipped with the plating liquid attachment component supplied to the peripheral face of said rotating drum, contacting the peripheral face of said rotating drum and holding plating liquid.
[Claim 3] Said plating liquid attachment component is the manufacturing installation of the metallic foil according to claim 2 constituted with 1 or two or more plating rollers with which the plating liquid maintenance layer supplied to the peripheral face of said rotating drum, holding plating liquid while rotating, where the peripheral face is contacted according to rotation of said rotating drum was prepared in the periphery section.
[Claim 4] Said plating liquid attachment component is the manufacturing installation of the metallic foil indicated to claim 2 which contacts the peripheral face of said rotating drum in the state of press sliding, or 3.
[Claim 5] Said a part of plating liquid attachment component [at least] is the manufacturing installation of the metallic foil indicated in any 1 term of claims 2-4 arranged more nearly up than the horizontal line passing through the center of rotation of a rotating drum.
[Claim 6] Said rotating drum is the manufacturing installation of the metallic foil indicated in any 1 term of claims 1-5 in which the non-galvanizing section laid underground so that an insulating material might expose a metallic foil on a front face to a part of peripheral face which carries out electrolytic deposition was formed.
[Claim 7] Said exfoliation means is the manufacturing installation of the metallic foil indicated in any 1 term of claims 1-6 equipped with the conveyance supporting material with which the adhesive layer was formed in one field, the sticking-by-pressure roller which presses the adhesive layer of this conveyance supporting material to the metallic foil which carried out electrolytic deposition to the peripheral face of said rotating drum, and a migration means to move the conveyance supporting material to which the metallic foil adhered in the direction of the outside of a path of said rotating drum.
[Claim 8] The rotating drum with which it was supported free [rotation] and the peripheral face was made into the negative electrode side, and a plating liquid supply means to supply plating liquid to the peripheral face of said rotating drum, The plating means equipped with the positive electrode member which it flows [member] electrically with the peripheral face of said rotating drum through the plating liquid supplied from this plating liquid supply means, and carries out electrolytic deposition of the metallic foil to the peripheral face of said rotating drum, The field means forming which forms a field in the field which carries out electrolytic deposition of the metallic foil to the peripheral face of said rotating drum with said plating means, A plating liquid washing means to wash the plating liquid adhering to the metallic foil which it was prepared in the downstream of said plating means, and carried out electrolytic deposition to the peripheral face of said rotating drum to the hand of cut of said rotating drum, A desiccation means to dry the metallic foil which it was prepared in the downstream

of said plating liquid washing means, and carried out electrolytic deposition to the peripheral face of said rotating drum to the hand of cut of said rotating drum, The manufacturing installation of a metallic foil which has an exfoliation means to exfoliate the metallic foil which it was prepared in the downstream of said desiccation means, and carried out electrolytic deposition to the peripheral face of said rotating drum to the hand of cut of said rotating drum from said peripheral face.

[Claim 9] Said plating liquid supply means is the manufacturing installation of the metallic foil indicated to claim 8 equipped with the plating liquid attachment component supplied to the peripheral face of said rotating drum, contacting the peripheral face of said rotating drum in the state of press sliding, and holding plating liquid.

[Claim 10] The plating process which the peripheral face and positive electrode member of said rotating drum which were used as the negative electrode are energized [process] through said plating liquid, and carries out electrolytic deposition of the metallic foil to the peripheral face of said rotating drum, supplying plating liquid to the peripheral face of a rotating drum, The washing process which washes the plating liquid adhering to the metallic foil which carried out electrolytic deposition to the peripheral face of said rotating drum, The manufacture approach of a metallic foil of having the desiccation process dried after washing the metallic foil which carried out electrolytic deposition to the peripheral face of said rotating drum, and the exfoliation process which exfoliates from the peripheral face of said rotating drum after drying the metallic foil which carried out electrolytic deposition to the peripheral face of said rotating drum.

[Claim 11] The plating liquid attachment component supplied to the peripheral face of said rotating drum, contacting the peripheral face of said rotating drum in the state of press sliding, and holding plating liquid is prepared. Said plating process supplying plating liquid to the contact section of the peripheral face of said rotating drum, and said plating liquid attachment component by said plating liquid attachment component The manufacture approach of the metallic foil indicated to claim 10 which the peripheral face and positive electrode member of said rotating drum which were used as the negative electrode are energized [claim] through said plating liquid, and carries out electrolytic deposition of the metallic foil to said contact section.

[Claim 12] Said exfoliation process is the manufacture approach of a metallic foil of having indicated the metallic foil to claim 10 which exfoliates from the peripheral face of said rotating drum, or 11, by moving the conveyance supporting material to which the adhesive layer formed in one field of conveyance supporting material was made to adhere to the metallic foil which carried out electrolytic deposition to the peripheral face of said rotating drum, and the metallic foil adhered in the direction of the outside of a path of said rotating drum.

[Claim 13] The manufacturing installation of the piece of a metallic foil which was equipped with the rotating drum indicated in any 1 term of claims 1-5, the plating means, the plating liquid washing means, and the desiccation means, replaced with the exfoliation means indicated to this claim, was prepared in the downstream of said desiccation means to the hand of cut of a rotating drum, and established a fragmentation exfoliation means exfoliated dividing the metallic foil which carried out electrolytic deposition to the peripheral face of said rotating drum from said peripheral face.

[Claim 14] Said rotating drum is the manufacturing installation of the piece of a metallic foil which indicated the metallic foil to claim 13 by which much rill sections were formed in the peripheral face which carries out electrolytic deposition.

[Claim 15] The manufacture approach of the piece of a metallic foil which established the fragmentation exfoliation process of exfoliating dividing from the peripheral face of said rotating drum after drying the metallic foil which was equipped with the plating process, washing process, and desiccation process which were indicated to claim 10 or 11, replaced with the exfoliation process indicated to this claim, and carried out electrolytic deposition to the peripheral face of a rotating drum.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to the manufacturing installation and the manufacture approach of a metallic foil and the piece of a metallic foil that the piece of a metallic foil which divided the metallic foil in the shape of a scale in metallic foil lists, such as copper foil and a noble-metals foil, can be manufactured continuously.
[0002]
[Description of the Prior Art] A metallic foil is various as the object for a function or the material for an ornament of electronic parts, electrode components, a catalyst, and other various members, and is used. The thickness of the metallic foil by rolling although the metallic foil was conventionally manufactured by rolling is 30 micrometers. Extent is a limit and a difficult thing also has rolling like Mo system alloy depending on the quality of the material. In recent years, the manufacturing installation of a metallic foil which the thinner thing was required from the cost side, the engine-performance side, etc., and used electroplating to this demand also about the metallic foil, and the approach are proposed.
[0003] Drawing 13 shows an example of the continuation manufacturing installation using electroplating of a metallic foil, and is equipped with the plating bath tub 103 equipped with the diaphragm 102 which regulates the bath surface of a plating bath 101, the rotating drum 105 supported free [rotation] while being immersed, after the upper part had been exposed during the plating bath 101, and the positive electrode member 106 divided and arranged within a plating bath 101 at the periphery section of a rotating drum 105. Said rotating drum 105 is electrically made into negative potential to the positive electrode member 106, and the peripheral face constitutes the negative electrode side. Moreover, in the plating bath 101, plating liquid is equally injected toward the peripheral face of a rotating drum 105 from two or more injection nozzles 107 prepared in the periphery section of a rotating drum 105.
[0004] If it energizes to an electrode, rotating said rotating drum 105, according to rotation of a rotating drum 105, a plating coat will carry out electrolytic deposition to the peripheral face of a rotating drum 105, this will grow, and the metallic foil 110 of predetermined thickness will be formed. The exfoliation roller 108 is attached to the upper part of a rotating drum 105, and it exfoliates from the peripheral face of a rotating drum 105 through the exfoliation roller 108, and a metallic foil 110 is conveyed to the rinsing process of a back process, and a desiccation process, and is rolled round.
[0005] On the other hand, in the condition as it is, the metal powder by which flat processing was carried out is used as an ornament material of a fine-arts handicraft, or a coating is mixed and it is used for the shape of a scale as conductive coating material, a metallic paint, etc. As such scale-like metal powder, application nature and what is especially as thin as possible from a viewpoint of economical efficiency with noble metals are required.
[0006] Conventionally, the processing approach which a detailed piece is made to divide is taken, it striking the sheet metal rolled out further, and extending it more thinly, after it carries out flat processing or scale-like metal powder extends a material metal with rolling to the shape of a scale as thinly as possible in the case of noble metals, dividing material metal powder with a ball mill.
[0007]
[Problem(s) to be Solved by the Invention] however, by the manufacturing installation using the conventional electroplating of a metallic foil, and the manufacture approach The metallic foil in which the big plating bath tub which holds a rotating drum is required for, and exfoliated from the rotating drum further A next rinsing process, The carrier facility for conveying at a desiccation process, the spray washer which carries out these down stream processing, and a dryer are needed, an equipment configuration becomes large-sized, and if it lengthens, there is a problem that a big installation tooth space is required and facility cost also becomes high.

[0008] Moreover, although based also on a plating kind, in exfoliation of a metallic foil, it is 20 micrometers. The thickness of extent is required and it is 10 micrometers. If it becomes extent, it will be torn in the case of exfoliation, or a wrinkling comes together. Moreover, also in a subsequent rinsing process and a desiccation process, in order to perform consecutive processing, it requires synchronizing a carrier facility with rotation of a rotating drum and high degree of accuracy so that neither a tear nor a wrinkling may arise in a metallic foil, and a large-scale and expensive high precision carrier facility is needed. Since that handling and migration between processes serve as a delicate activity so that a metallic foil becomes a thin film, this inclination becomes remarkable.

[0009] Moreover, by the manufacturing installation of the conventional metallic foil, and the manufacture approach, in the early stages of electrolytic deposition, a deposit of a plating coat is unstable, and it is hard to deposit in homogeneity for oxidation of the front face of a rotating drum, or formation of a passive state coat, and is especially several micrometers. In the thin film of extent, a plating metal carries out electrolytic deposition to the shape of a dent light, and becomes uneven [an appearance], and a pit and a countless pinhole are generate, thickness also tends to become an ununiformity, and there is a problem that quality deteriorates.

[0010] In order to manufacture metal powder, atomizing molten metal etc. needs to be furnished of the approach of on the other hand processing metal powder in the shape of a scale in the manufacture approach of the conventional scale-like metal powder, large-scale. Moreover, by the technique of striking and extending the sheet metal obtained by rolling, it is inferior to productivity and there is a problem that a manufacturing cost becomes high. Moreover, although the piece of a metallic foil equivalent to scale-like metal powder is obtained by dividing a metallic foil, since it is difficult to obtain a comparatively thin metallic foil itself as stated previously, there is a problem that thin film-like the piece of a metallic foil is hard to be obtained.

[0011] This invention was made in view of this problem, and there are few installation tooth spaces, and they end and it offers the manufacturing installation and the manufacture approach of a metallic foil that a thin film-like metallic foil can be continuously manufactured by the easy equipment configuration. Moreover, when a metallic foil is a thin film, the manufacturing installation and the manufacture approach of a metallic foil that the metallic foil of high quality can be stably manufactured continuously with an easy facility are offered. Moreover, the manufacturing installation and the manufacture approach of the piece of a metallic foil that thin film-like the piece of a metallic foil can be stably manufactured continuously with an easy facility are offered.

[0012]

[Means for Solving the Problem] The rotating drum with which the manufacturing installation of the metallic foil indicated to claim 1 was supported free [rotation], and the peripheral face was made into the negative electrode side, The plating means equipped with the positive electrode member which it flows [member] electrically with the peripheral face of said rotating drum through the plating liquid supplied from the plating liquid supply means and this plating liquid supply means of supplying plating liquid to the peripheral face of said rotating drum, and carries out electrolytic deposition of the metallic foil to the peripheral face of said rotating drum, A plating liquid washing means to wash the plating liquid adhering to the metallic foil which it was prepared in the downstream of said plating means, and carried out electrolytic deposition to the peripheral face of said rotating drum to the hand of cut of said rotating drum, A desiccation means to dry the metallic foil which it was prepared in the downstream of said plating liquid washing means, and carried out electrolytic deposition to the peripheral face of said rotating drum to the hand of cut of said rotating drum, To the hand of cut of said rotating drum, it is prepared in the downstream of said desiccation means, and has an exfoliation means to exfoliate the metallic foil which carried out electrolytic deposition to the peripheral face of said rotating drum from said peripheral face. Since the metallic foil which carried out electrolytic deposition to the peripheral face of a rotating drum with the plating means is held according to this manufacturing installation, adhered to the peripheral face of a rotating drum, in case it is washed by the plating liquid washing means and dries with a desiccation means according to rotation of a rotating drum, even if a metallic foil is a thin film, it is hard to produce a tear and a wrinkling in a metallic foil, and the metallic foil of high quality can be manufactured continuously and stably. Moreover, the mass plating bath tub which can hold a rotating drum and the carrier facility which conveys a metallic foil to a washing process or a desiccation process which was needed conventionally according to the manufacturing installation of this invention, and cleaning equipment and a dryer are unnecessary, since a plating means etc. is attached to the periphery section of a rotating drum, it is easy, there are also few installation tooth spaces, and it ends, and facility cost is also cheap and an equipment configuration also ends.

[0013] Moreover, in the manufacturing installation which indicated the manufacturing installation of the metallic foil indicated to claim 2 to claim 1, said plating liquid supply means contacts the peripheral face of said rotating drum, and it is equipped with the plating liquid attachment component supplied to the peripheral face of said rotating drum, holding plating liquid. According to this manufacturing installation, the peripheral face and plating liquid attachment component of a rotating drum have contacted, and since plating liquid is held at a plating liquid

attachment component and exists, a positive electrode member comes to flow certainly electrically in the peripheral face of a rotating drum only by contacting a plating liquid attachment component, and can perform electrolytic deposition stably by small plating volume.

[0014] Moreover, in a manufacturing installation according to claim 2, where the peripheral face is contacted according to rotation of said rotating drum, while said plating liquid attachment component rotates, it is constituted by 1 or two or more plating rollers with which the plating liquid maintenance layer supplied to the peripheral face of said rotating drum was prepared in the periphery section, the manufacturing installation of the metallic foil indicated to claim 3 holding plating liquid. according to this manufacturing installation -- the contact section of the peripheral face of a plating roller, and the peripheral face of a rotating drum -- plating liquid tends to collect also between the contact sections of two or more plating rollers suitably, according to rotation of a rotating drum, plating liquid can be more stably supplied to the peripheral face of a rotating drum, and electrolytic deposition of the plating coat can be more stably carried out to it. Moreover, since a plating liquid attachment component is exchangeable by exchanging a plating roller, maintenance nature is good.

[0015] Moreover, said plating liquid attachment component is prepared so that the manufacturing installation of the metallic foil indicated to claim 4 may contact the peripheral face of said rotating drum in the state of press sliding in a manufacturing installation according to claim 2 or 3. Since the metal crystalline structure of the plating coat which can prevent that the peripheral face of said rotating drum is washed continuously, and a foreign matter is involved in the plating coat which carried out electrolytic deposition in order that according to this manufacturing installation a plating liquid attachment component may carry out press sliding and may rub the peripheral face of a rotating drum, in case electrolytic deposition of the metallic foil is carried out to the peripheral face of a rotating drum with a plating means, and carries out electrolytic deposition becomes precise, the metallic foil of high quality without a defect is generable with a thin film.

[0016] Moreover, said a part of plating liquid attachment component [at least] is arranged more nearly up than the horizontal line where the manufacturing installation of the metallic foil indicated to claim 5 passes along the center of rotation of a rotating drum in a manufacturing installation given in any 1 term of claims 2-4. According to this manufacturing installation, by supplying plating liquid to a part of plating liquid attachment component located more nearly up than the horizontal line passing through the center of rotation of a rotating drum, the supplied plating liquid becomes easy to flow to the peripheral face side of a rotating drum through a plating liquid attachment component, can supply plating liquid to the contact section of a plating liquid attachment component and the peripheral face of a rotating drum more stably, without opposing gravity, and can promote the stable electrolytic deposition of a plating coat.

[0017] Moreover, as for the manufacturing installation of the metallic foil indicated to claim 6, the non-galvanizing section by which the insulating material was laid under a part of peripheral face to which said rotating drum carries out electrolytic deposition of the metallic foil in a manufacturing installation given in any 1 term of claims 1-5 so that it might expose at a front face is formed. It can manufacture continuously, without performing configuration cutting processing according in the metallic foil which the hole opened to the part corresponding to the non-galvanizing section, for example, the metallic foil which has a specific flat-surface configuration like a substrate pattern, to a press etc., since electrolytic deposition of the plating coat is not carried out to the non-galvanizing section formed in the peripheral face of a rotating drum according to this manufacturing installation.

[0018] Moreover, the manufacturing installation of the metallic foil indicated to claim 7 is equipped with a migration means by which said exfoliation means moves the conveyance supporting material with which the adhesive layer was formed in one field, the sticking-by-pressure roller pressed to the metallic foil which carried out electrolytic deposition of the adhesive layer of this conveyance supporting material to the peripheral face of said rotating drum, and the conveyance supporting material to which the metallic foil adhered in the direction of the outside of a path of said rotating drum, in a manufacturing installation given in any 1 term of claims 1-6. A metallic foil exfoliates easily from the peripheral face of a rotating drum by migration of conveyance supporting material, without the tension for exfoliation carrying out a direct action to a metallic foil, since the conveyance supporting material with which the sticking-by-pressure roller adhered to the metallic foil is moved in the direction of the outside of a path of a rotating drum by the migration means according to this manufacturing installation. For this reason, even when a metallic foil is a thin film, it can exfoliate stably from the peripheral face of a rotating drum. Moreover, also about the handling after exfoliation, since conveyance supporting material adheres to the metallic foil, without carrying out the direct action of the external force to a metallic foil, it is dealt with, and it can carry out things, also in the case of a thin film, is dealt with, is excellent in a sex, and can prevent the damage in the case of handling effectively.

[0019] The rotating drum with which the manufacturing installation of the metallic foil indicated to claim 8 was supported free [rotation], and the peripheral face was made into the negative electrode side, The plating means equipped with the positive electrode member which it flows [member] electrically with the peripheral face of

said rotating drum through the plating liquid supplied from the plating liquid supply means and this plating liquid supply means of supplying plating liquid to the peripheral face of said rotating drum, and carries out electrolytic deposition of the metallic foil to the peripheral face of said rotating drum, The field means forming which forms a field in the field which carries out electrolytic deposition of the metallic foil to the peripheral face of said rotating drum with said plating means, A plating liquid washing means to wash the plating liquid adhering to the metallic foil which it was prepared in the downstream of said plating means, and carried out electrolytic deposition to the peripheral face of said rotating drum to the hand of cut of said rotating drum, A desiccation means to dry the metallic foil which it was prepared in the downstream of said plating liquid washing means, and carried out electrolytic deposition to the peripheral face of said rotating drum to the hand of cut of said rotating drum, To the hand of cut of said rotating drum, it is prepared in the downstream of said desiccation means, and has an exfoliation means to exfoliate the metallic foil which carried out electrolytic deposition to the peripheral face of said rotating drum from said peripheral face. Like [according to this manufacturing installation] invention indicated to claim 1, since the metallic foil which carried out electrolytic deposition to the peripheral face of a rotating drum with the plating means is held adhered to the peripheral face of a rotating drum, in case it is washed by the plating liquid washing means according to rotation of a rotating drum and dries with a desiccation means, even if a metallic foil is a thin film, it is hard to produce a tear and a wrinkling and it can carry out continuation manufacture of the metallic foil of high quality stably. Moreover, a facility configuration is also easy, and there are also few installation tooth spaces and they end. Furthermore, in case electrolytic deposition of the metallic foil which consists of a ferromagnetic alloy is carried out, by forming a field by field means forming, the metallic crystal which carries out electrolytic deposition in an operation of a field comes to turn to a specific direction, and it can manufacture by low cost continuously, the metallic foil, i.e., the magnetic tape, which consists of a ferromagnetic thin film of high quality.

[0020] Moreover, in a manufacturing installation according to claim 8, said plating liquid supply means contacts the peripheral face of said rotating drum in the state of press sliding, and the manufacturing installation of the metallic foil indicated to claim 9 is equipped with the plating liquid attachment component supplied to the peripheral face of said rotating drum, holding plating liquid. According to this manufacturing installation, in case electrolytic deposition of the metallic foil is carried out to the peripheral face of a rotating drum with a plating means, a positive electrode member comes to flow certainly electrically in the peripheral face of a rotating drum only by contacting a plating liquid attachment component, and can perform electrolytic deposition stably by small plating volume. Furthermore, since the metal crystalline structure of the plating coat which can prevent that the peripheral face of a rotating drum is washed continuously and a foreign matter is involved in the plating coat which carried out electrolytic deposition in order that a plating liquid attachment component may carry out press sliding and may rub the peripheral face of a rotating drum in the case of electrolytic deposition, and carries out electrolytic deposition becomes precise, the metallic foil of high quality without a defect is generable with a thin film.

[0021] The manufacture approach of the metallic foil indicated to claim 10 supplying plating liquid to the peripheral face of a rotating drum The plating process which the peripheral face and positive electrode member of said rotating drum which were used as the negative electrode are energized [process] through said plating liquid, and carries out electrolytic deposition of the metallic foil to the peripheral face of said rotating drum, The washing process which washes the plating liquid adhering to the metallic foil which carried out electrolytic deposition to the peripheral face of said rotating drum, It has the desiccation process dried after washing the metallic foil which carried out electrolytic deposition to the peripheral face of said rotating drum, and the exfoliation process which exfoliates from the peripheral face of said rotating drum after drying the metallic foil which carried out electrolytic deposition to the peripheral face of said rotating drum. According to this manufacture approach, it is hard to produce a tear and a wrinkling and the metallic foil which carried out electrolytic deposition to the peripheral face of a rotating drum according to the plating process can carry out continuation manufacture of the metallic foil of high quality stably by the easy manufacturing installation, even if a metallic foil is a thin film in case it is washed by the plating liquid washing process according to rotation of a rotating drum and a desiccation process dries since it is held adhered to the peripheral face of a rotating drum.

[0022] Moreover, the manufacture approach of the metallic foil indicated to claim 11 In the manufacture approach according to claim 10, the peripheral face of said rotating drum is contacted in the state of press sliding. Preparing the plating liquid attachment component supplied to the peripheral face of said rotating drum, holding plating liquid, and said plating process supplying plating liquid to the contact section of the peripheral face of said rotating drum, and said plating liquid attachment component by said plating liquid attachment component The peripheral face and positive electrode member of said rotating drum which were used as the negative electrode are energized through said plating liquid, and electrolytic deposition of the metallic foil is carried out to said contact section. According to this manufacture approach, in case electrolytic deposition of

the metallic foil is carried out to the peripheral face of a rotating drum according to a plating process, a positive electrode member comes to flow certainly electrically in the peripheral face of a rotating drum only by contacting a plating liquid attachment component, and can perform electrolytic deposition stably by small plating volume. Furthermore, since the metal crystalline structure of the plating coat which can prevent that the peripheral face of a rotating drum is washed continuously and a foreign matter is involved in the plating coat which carried out electrolytic deposition in order that a plating liquid attachment component may carry out press sliding and may rub the peripheral face of a rotating drum in the case of electrolytic deposition, and carries out electrolytic deposition becomes precise, the metallic foil of high quality without a defect is generable with a thin film.

[0023] Moreover, a metallic foil is exfoliated from the peripheral face of said rotating drum by moving the conveyance supporting material to which said exfoliation process made the manufacture approach of the metallic foil indicated to claim 12 adhere to the metallic foil which carried out electrolytic deposition of the adhesive layer formed in one field of conveyance supporting material to the peripheral face of said rotating drum in the manufacture approach according to claim 10 or 11, and the metallic foil adhered in the direction of the outside of a path of said rotating drum. A metallic foil exfoliates easily from the peripheral face of a rotating drum by migration of conveyance supporting material, without the tension for exfoliation carrying out a direct action to a metallic foil, in order to move the conveyance supporting material to which the metallic foil was made to adhere to conveyance supporting material, and the metallic foil adhered in the direction of the outside of a path of a rotating drum according to this manufacture approach. For this reason, even when a metallic foil is a thin film, it can exfoliate stably from the peripheral face of a rotating drum. Moreover, also about the handling after exfoliation, since conveyance supporting material adheres to the metallic foil, without carrying out the direct action of the external force to a metallic foil, it is dealt with, and it can carry out things, also in the case of a thin film, is dealt with, is excellent in a sex, and can prevent the damage in the case of handling effectively.

[0024] The manufacturing installation of the piece of a metallic foil indicated to claim 13 is equipped with the rotating drum indicated in any 1 term of claims 1-5, a plating means, a plating liquid washing means, and a desiccation means, replaces with the exfoliation means indicated to this claim, is prepared in the downstream of said desiccation means to the hand of cut of a rotating drum, and establishes a fragmentation exfoliation means exfoliate dividing the metallic foil which carried out electrolytic deposition to the peripheral face of said rotating drum from said peripheral face. That is, the manufacturing installation of the piece of a metallic foil of this invention is following (1). - (5) The manufacturing installation of the piece of a metallic foil is included.

(1) The rotating drum with which it was supported free [rotation] and the peripheral face was made into the negative electrode side, A plating liquid supply means to supply plating liquid to the peripheral face of said rotating drum, The plating means equipped with the positive electrode member which it flows [member] electrically with the peripheral face of said rotating drum through the plating liquid supplied from this plating liquid supply means, and carries out electrolytic deposition of the metallic foil to the peripheral face of said rotating drum, A plating liquid washing means to wash the plating liquid adhering to the metallic foil which it was prepared in the downstream of said plating means, and carried out electrolytic deposition to the peripheral face of said rotating drum to the hand of cut of said rotating drum, A desiccation means to dry the metallic foil which it was prepared in the downstream of said plating liquid washing means, and carried out electrolytic deposition to the peripheral face of said rotating drum to the hand of cut of said rotating drum, The manufacturing installation of the piece of a metallic foil which was prepared in the downstream of said desiccation means and established a fragmentation exfoliation means to exfoliate dividing the metallic foil which carried out electrolytic deposition to the peripheral face of said rotating drum from said peripheral face, to the hand of cut of said rotating drum.

(2) Said plating liquid supply means is the above (1) equipped with the plating liquid attachment component supplied to the peripheral face of said rotating drum, contacting the peripheral face of said rotating drum and holding plating liquid. Manufacturing installation of the indicated piece of a metallic foil.

(3) Said plating liquid attachment component is the above (2) constituted with 1 or two or more plating rollers with which the plating liquid maintenance layer supplied to the peripheral face of said rotating drum, holding plating liquid while rotating, where the peripheral face is contacted according to rotation of said rotating drum was prepared in the periphery section. Manufacturing installation of the piece of a metallic foil of a publication.

(4) Said plating liquid attachment component is the above (2) which contacts the peripheral face of said rotating drum in the state of press sliding. Or (3) Manufacturing installation of the indicated piece of a metallic foil.

(5) the above (2) arranged more nearly up than the horizontal line where said a part of plating liquid attachment component [at least] passes along the center of rotation of a rotating drum from -- (4) Manufacturing installation of the piece of a metallic foil indicated in any 1 term.

The operation as stated above based on the predetermined configuration of invention which was indicated to claims 1-5 (above (1) - (5)) according to the manufacturing installation of the piece of a metallic foil indicated to

said claim 13, Also in the case of a thin film, since effect is taken, and also it exfoliates while the metallic foil formed in the peripheral face of a rotating drum is divided by the fragmentation exfoliation means, the piece of a metallic foil of fixed thickness can be manufactured continuously easily [a stabilization target] by the easy manufacturing installation.

[0025] Moreover, much rill sections are formed in the peripheral face to which said rotating drum carries out electrolytic deposition of the metallic foil in the manufacturing installation of the piece of a metallic foil which indicated the manufacturing installation of the piece of a metallic foil indicated to claim 14 to claim 13. Since according to the manufacturing installation of this piece of a metallic foil much rill sections are formed in the peripheral face of a rotating drum and this rill section is hard to be galvanized as compared with the outside surface of a rotating drum, thickness becomes thin, or the part of the metallic foil corresponding to the rill section serves as the non-galvanizing section, when remarkable. For this reason, in case fragmentation exfoliation of this metallic foil is carried out, a metallic foil can be easily divided to a split along with the rill section, and the superficial size of the piece of a metallic foil by which fragmentation exfoliation is carried out can be easily adjusted by setting up the flute width of the rill section, and arrangement spacing suitably.

[0026] The manufacture approach of the piece of a metallic foil indicated to claim 15 is equipped with the plating process, washing process, and desiccation process which were indicated to claim 10 or 11, and establishes the fragmentation exfoliation process of exfoliating dividing from the peripheral face of said rotating drum after drying the metallic foil which replaced with the exfoliation process indicated to this claim, and carried out electrolytic deposition to the peripheral face of a rotating drum. That is, the manufacture approach of the piece of a metallic foil of this invention is following (1). (2) The manufacturing installation of the piece of a metallic foil is included.

(1) The plating process which the peripheral face and positive electrode member of said rotating drum which were used as the negative electrode are energized [process] through said plating liquid, and carries out electrolytic deposition of the metallic foil to the peripheral face of said rotating drum, supplying plating liquid to the peripheral face of a rotating drum, The washing process which washes the plating liquid adhering to the metallic foil which carried out electrolytic deposition to the peripheral face of said rotating drum, The manufacture approach of the piece of a metallic foil which has the fragmentation exfoliation process of exfoliating dividing from the peripheral face of said rotating drum after drying the metallic foil which carried out electrolytic deposition to the desiccation process dried after washing the metallic foil which carried out electrolytic deposition to the peripheral face of said rotating drum, and the peripheral face of said rotating drum.

(2) Prepare the plating liquid attachment component supplied to the peripheral face of said rotating drum, contacting the peripheral face of said rotating drum in the state of press sliding, and holding plating liquid. Said plating process supplying plating liquid to the contact section of the peripheral face of said rotating drum, and said plating liquid attachment component by said plating liquid attachment component The above the peripheral face and positive electrode member of said rotating drum which were used as the negative electrode are energized through said plating liquid, and electrolytic deposition of the metallic foil is carried out [above] to said contact section (1) The manufacture approach of the indicated piece of a metallic foil.

according to the manufacturing installation of the piece of a metallic foil indicated to said claim 15 -- claims 10 and 11 (the above (1) --) (2) Since the operation as stated above based on the predetermined process of indicated invention and effectiveness are done so, and also it exfoliates while the metallic foil formed in the peripheral face of a rotating drum of the fragmentation exfoliation process is divided Also in the case of a thin film, the piece of a metallic foil of fixed thickness can be manufactured continuously easily [a stabilization target] by the easy manufacturing installation.

[0027]

[Embodiment of the Invention] Drawing 1 shows the whole manufacturing installation block diagram of the metallic foil concerning the operation gestalt of this invention, and is equipped with the rotating drum 1 of the shape of a cylinder supported free [rotation], and the plating means 2, the plating liquid recovery means 3, the plating liquid washing means 4, the penetrant remover removal means 5, the desiccation means 6, and the exfoliation means 7 are attached at the same order foreword from the direction upper limit of a vertical along the hand of cut of this rotating drum 1.

[0028] As shown in drawing 2 , the cylindrical periphery section 11 is attached in the revolving shaft 13 by the end plate 12 of a Uichi Hidari pair, the peripheral face is processed on a mirror plane, and said rotating drum 1 is made into the electrolytic deposition side of a metallic foil. The quality of the material of a rotating drum 1 has corrosion resistance to plating liquid, and especially a peripheral face is formed by the ingredient which forms a passive state coat so that the metallic foil which carried out electrolytic deposition may tend to exfoliate, for example, stainless steel, and titanium. The whole rotating drum 1 may be formed with stainless steel, and a chrome plating layer may be further formed in the peripheral face of the periphery section 11. Moreover, an end

plate 12 and a revolving shaft 13 may be formed with stainless steel, and only the periphery section 11 may be formed by titanium. Moreover, a rotating drum 1 is connected to the negative electrode of a plating power source, and the peripheral face is made into a negative electrode side.

[0029] Said plating means 2 is arranged in parallel and arranged in a hoop direction at the periphery section of a rotating drum 1, and it has two or more plating rollers 21 which contact the peripheral face of a rotating drum 1 in the state of press sliding, and has a plating liquid supply means 20 to supply plating liquid to said peripheral face through this plating roller. This plating liquid supply means 20 is equipped with the plating liquid supply box 23 in which two or more injection nozzles 22 which inject thru/or spray plating liquid on each plating roller 21 were formed. The plating liquid supply pipe 39 is connected to this plating liquid supply box 23, and plating liquid is supplied to said plating liquid supply pipe 39 through a closing motion valve and a flow control valve from the plating liquid hold tank which carried out the illustration abbreviation.

[0030] Said plating roller 21 and the plating liquid supply box 23 are supported by the support plate 24, and said support plate 24 is attached through the flexible column 25 driven according to the pressurization adjustment device which carried out the illustration abbreviation. As said pressurization adjustment device, a hydrostatic pressure cylinder, a motor cylinder, etc. can be used, for example. In addition, you may make it attach said support plate 24 to the flexible member (for example, piston rod) of a pressurization adjustment device direct picking through the flexible column 25.

[0031] Each plating roller 21 is pressed by the pressure moderate to the peripheral face of a rotating drum 1 by telescopic motion of said flexible column 25. This pressure is 2 10-100g/cm. Extent is desirable. Although based also on the damping force which controls rotation of the plating roller 21, if a pressure is too weak, the friction effectiveness by sliding to the peripheral face of the rotating drum 1 of the plating roller 21 will become [too little], and if a pressure is too high, on the other hand, the plating coat which carried out electrolytic deposition will come to be removed. Moreover, the liquid pool ring 15 for outflow prevention of plating liquid is attached to the both ends of the peripheral face of a rotating drum 1, and said plating roller 21 is installed in the shape of fitting inside this liquid pool ring 15. In addition, said plating roller 21 is equivalent to the plating liquid attachment component of this invention.

[0032] As said plating roller 21 is shown in drawing 2 , it has the revolving shaft 27 arranged at the shaft orientations of a rotating drum 1, and parallel, and the plating liquid maintenance layer 28 which holds plating liquid free [absorption discharge] around it is formed. Said revolving shaft 27 is formed by the metal material which has corrosion resistance to plating liquid, for example, stainless steel, and the positive electrode member 29 which consists of a lead layer is formed in the periphery section. As said plating liquid maintenance layer 28, it is not corroded by plating liquid but plating liquid can be held free [absorption discharge] by capillarity, it has moderate resiliency, for example, synthetic-resin sponge, the thing which tied up fiber and hair into a knot, the felt, a nonwoven fabric, etc. can be used. In addition, said revolving shaft 27 and the positive electrode member 29 are the configurations in the case of manufacturing copper foil by copper plating, for example, when manufacturing a noble-metals foil, they form a revolving shaft by titanium, and they should just form a positive electrode member in a platinum layer (for example, plating coat). Moreover, what is necessary is to form the revolving shaft itself with nickel, when manufacturing nickel foil, and just to serve as a positive electrode member. Also in copper foil, the revolving shaft itself is formed with copper, and it can serve as a positive electrode member.

[0033] As said plating roller 21 is shown in drawing 2 , the both ends of a revolving shaft 27 are supported free [rotation] through bearing 32 by the side plate 31 of a pair attached in the front end section and the back end section of a support plate 24, and rotation of the plating roller 21 is braked by the brake mechanism 33 prepared in said side plate 31. The brake mechanism 33 consists of the slide member 34 constructed over the axis end upper part of the revolving shaft 27 of two or more plating rollers 21, a spring 35 which energizes this slide member 34 to each axis end side, an attachment component 36 which carries out hold maintenance of the upper part of this spring 35, and a **** member 37 which is attached in this attachment component 36, presses down the resiliency of said spring 35, and is adjusted through a plate. The plating roller 21 pressed by the peripheral face of a rotating drum 1 is adjusting the thrust of the slide member 34 which contacts a revolving shaft 27 according to said brake mechanism 33 in this case, although follower rotation is carried out according to frictional force by rotation of a rotating drum 1, and rotation of the plating roller 21 is braked by the frictional force produced in the contact section of a revolving shaft 27 and a slide member 34. Thereby, the plating liquid maintenance layer 28 prepared in the periphery section of the plating roller 21 is rotated, sliding in the state of press on the peripheral face of a rotating drum 1. Said slide member 34 functions also as an electric supply brush to the positive electrode member 29 attached to the revolving shaft 27 of each plating roller 21, it connects electrically and each slide member 34 is connected to the positive electrode of a plating power source.

[0034] Said plating roller 21 is good to arrange along the hand of cut of a rotating drum 1 from the include angle of the direction upper limit of a vertical to 10 degrees or more. Thereby, it can prevent that plating liquid flows into the exfoliation means 7 side, without using a liquid end member. Moreover, the lowermost plating roller 21 is good to measure from the direction upper limit of a vertical of a rotating drum 1 to a hand of cut, and to arrange before about 135 degrees, and the topmost plating roller 21 at least is better than the horizontal line (the inside of drawing 1 , H-H line) passing through the center of rotation of a rotating drum 1 to arrange up. Moreover, the end connection to the plating liquid supply box 23 of the plating liquid supply pipe 39 is also better than the horizontal line passing through the center of rotation of a rotating drum 1 to prepare up so that plating liquid may be enough supplied to the plating roller 21 of this topmost part. Thereby, the plating liquid supplied to the topmost plating roller 21 flows to the peripheral face side of a rotating drum 1 in response to an operation of gravity, and comes to flow along with a peripheral face, and the electrolytic deposition in the peripheral face of a rotating drum 1 stabilizes it. In addition, said plating liquid supply pipe 39 may prepare two or more things connected to the upper part of the plating liquid supply box 23, and may prepare two or more things further connected caudad from it.

[0035] Said plating liquid recovery means 3 is equipped with the liquid absorption roller 41 which carries out follower rotation according to rotation of a rotating drum 1 in contact with the peripheral face of a rotating drum 1, is discharged from the plating means 2 with this liquid absorption roller 41, and absorbs and collects the plating liquid transmitted in the peripheral face of a rotating drum 1. The plating liquid recovery means 3 is effective when using the plating liquid for noble-metals electrolytic deposition of high cost especially. The absorptive layer 43 to which said liquid absorption roller 41 becomes the surroundings of the revolving shaft 42 supported free [rotation] from said plating liquid maintenance layer 28 and this quality of the material is attached in the shape of a cylinder. Said revolving shaft 42 consists of perforated pipes, and the recovery tubing 44 connected to liquid absorption equipments, such as a vacuum pump, is attached in the axis end. The liquid absorption roller 41 absorbs the plating liquid with which the absorptive layer 43 has transmitted and flowed the peripheral face of a rotating drum 1, it being in contact with the peripheral face of a rotating drum 1 by the pressure which is extent in which a metallic foil does not exfoliate with proper energization means, such as a spring, and carrying out follower rotation by rotation of a rotating drum 1. The plating liquid absorbed by the absorptive layer 43 is collected and reused through a revolving shaft 42 and the recovery tubing 44.

[0036] Said plating liquid washing means 4 is equipped with the penetrant remover supply pipe 47 equipped with the injection nozzle 46 of a large number arranged along with the peripheral face of a rotating drum 1, and washes it by the penetrant remover which turned to the peripheral face of a rotating drum 1 the plating liquid adhering to the metallic foil which carried out electrolytic deposition to the peripheral face of a rotating drum 1 with the plating means 2, and injected it from the injection nozzle 46. Usually, water is used as a penetrant remover.

[0037] The penetrant remover removal means 5 which equipped the downstream of said plating liquid washing means 4 with said liquid absorption roller 41 and the liquid absorption roller 41 which has the same structure is attached to the peripheral face of a rotating drum 1, the penetrant remover after washing transmitted in the peripheral face of a rotating drum 1 is sucked up and removed, and the front face of a metallic foil makes it be easy to be dried. In addition, as a penetrant remover removal means, the liquid end member formed not only with said liquid absorption roller 41 but with for example, the Ayr blow, a rubber plate, etc. may be used.

[0038] Said desiccation means 6 dries a metallic foil, adhered to the peripheral face of a rotating drum 1 after washing of a metallic foil, and an infrared heater, a warm air blower, etc. are used. In addition, although a mere blower is sufficient as the desiccation means 6 and it does not necessarily require that it is what performs stoving, when using stoving devices, such as an infrared heater, the metallic foil which carried out electrolytic deposition to the peripheral face of a rotating drum 1 can be heated quickly, and there is an advantage to which a metallic foil becomes easy to exfoliate from the peripheral face of a rotating drum 1 by difference of the amount of thermal expansion resulting from the difference in the coefficient of thermal expansion of a metallic foil and the periphery section 11 of a rotating drum 1.

[0039] The conveyance supporting material 52 with which said exfoliation means 7 was rolled round by the film rewind spindle 51 free [a send], and the adhesive layer was formed in one field, The sticking-by-pressure roller 53 which this conveyance supporting material 52 is wrapped [roller] and makes the adhesive layer of the conveyance supporting material 52 press and adhere to the metallic foil which carried out electrolytic deposition to the peripheral face of a rotating drum 1 through the conveyance supporting material 52, The conveyance supporting material 52 to which the metallic foil adhered was wrapped, and it has the exfoliation roller 54 which exfoliates a metallic foil from a rotating drum 1 by sending this out in the direction of the outside of a path of a rotating drum 1.

[0040] The periphery section is formed of the flexible, comparatively high elastic material of coefficient of

friction of polyurethane rubber, silicone rubber, other synthetic rubber, such foamed rubbers, etc., said sticking-by-pressure roller 53 and the exfoliation roller 54 contact the peripheral face of a rotating drum 1 in the state of press through the conveyance supporting material 52, and the rotation drive is carried out synchronizing with the peripheral speed of a rotating drum 1. In addition, said exfoliation roller 54 is equivalent to the migration means of this invention. Moreover, said sticking-by-pressure roller 53 can be omitted, and only the exfoliation roller 54 concerned can also perform adhesion of the adhesive layer to a metallic foil, and exfoliation of a metallic foil.

[0041] The conveyance supporting material 52 sent out in the direction of the outside of a path with said exfoliation roller 54 is recovered by the recovery means 8 the whole metallic foil adhering to this. Although a take-up motion equipped with the paper winding shaft 55 which rolls round the conveyance supporting material 52 is used, you may make it only hold in a recovery box by the example of drawing as said recovery means 8.

[0042] As said conveyance supporting material 52, a resin tape, a paper tape, a cloth tape, a metal tape, etc. are used. Although the quality of the material of the conveyance supporting material 52 is suitably chosen by the quality of the material of a metallic foil, and thickness, as especially the thickness of a metallic foil becomes thin, since it becomes easy to produce damage in a metallic foil, an ingredient which using what has high reinforcement expands and contracts often and simply is not more desirable. In addition, it can consider as the exfoliation tape on which the conveyance supporting material 52 was applied to the release agent by the body of supporting material, and the metallic foil to which the adhesive layer adhered from the conveyance supporting material 52 can be easily exfoliated by forming an adhesive layer on a mold release layer. Moreover, what is necessary is to use the film and binder of a water-soluble thing, for example, a cellulose system, as conveyance supporting material or a binder, and just to carry out dissolution removal of these with hot water, in order to obtain a metallic foil without adhesion of an adhesive layer.

[0043] Next, the manufacture approach of the metallic foil using the above-mentioned manufacturing installation is explained. In order to carry out continuation manufacture of the metallic foil, electrolytic deposition of the metallic foil is first carried out to the peripheral face of a rotating drum 1 continuously according to a plating process. That is, a rotating drum 1 is rotated, constant feeding of the plating liquid is carried out from the plating liquid supply means 20, and a plating electrical potential difference is impressed to the positive electrode member 29 of a rotating drum 1 and the plating roller 21. The plating liquid supplied from the plating liquid hold tank minds the plating liquid supply box 23 and an injection nozzle 22, is injected thru/or sprayed by the plating roller 21, and it is supplied to the peripheral face of a rotating drum 1 while absorption maintenance is carried out by capillarity at the plating liquid maintenance layer 28 prepared in the periphery section of the plating roller 21. By this, the positive electrode member 29 attached to the revolving shaft 27 of the plating roller 21 and the peripheral face of a rotating drum 1 will be in switch-on, and a plating coat carries out electrolytic deposition to the peripheral face of a rotating drum 1. A plating coat grows, while passing the plating roller 21 one after another, and a metallic foil generates it continuously. In order that the plating liquid maintenance layer 28 prepared in the periphery section of the plating roller 21 may carry out press sliding and may rub the peripheral face of a rotating drum 1 in the case of the electrolytic deposition of a plating coat, the peripheral face of a rotating drum 1 is washed continuously, the contamination of the foreign matter to the plating coat which carried out electrolytic deposition is prevented, and since the metal crystalline structure of the plating coat which carries out electrolytic deposition becomes precise, the metallic foil of high quality without a defect and high performance is generable with a thin film.

[0044] Next, the plating liquid which adhered on the surface of the metallic foil is washed by a washing process and the desiccation process, and the metallic foil which carried out electrolytic deposition to the peripheral face of a rotating drum 1 according to said plating process is removed. That is, according to rotation of a rotating drum 1, it is washed by the plating liquid washing means 4, the penetrant remover on the front face of a metallic foil is removed in general by the penetrant remover removal means 5, and it dries with the desiccation means 6. It is hard to produce breakage and damage and these the processings of a series of can perform each processing stably, even if a metallic foil is a thin film, since it is carried out in the condition [that the metallic foil has adhered to the peripheral face of a rotating drum 1].

[0045] According to an exfoliation process, the metallic foil dried adhered to the peripheral face of a rotating drum 1 exfoliates from the front face of a rotating drum 1, and are collected at a recovery process. That is, according to rotation of a rotating drum 1, by the exfoliation means 7, after having been supported by the conveyance supporting material 52, it exfoliates continuously, and with the conveyance supporting material 52, it is rolled round by the paper winding shaft 55 and collected. Since the tension for exfoliation does not carry out a direct action to a metallic foil in the case of this exfoliation, even when a metallic foil is a thin film, it can exfoliate stably from the peripheral face of a rotating drum. Moreover, also about the handling after exfoliation and recovery, since conveyance supporting material adheres to the metallic foil, without carrying out the direct action of the external force to a metallic foil, it is dealt with, and it can carry out things and it is excellent

[metallic foil] in handling nature.
[0046] With the above-mentioned operation gestalt, although the plating field of the peripheral face of a rotating drum 1 was formed in the flat mirror plane, as shown in drawing 3 , the metallic foil which has various patterns (example of drawing (A) checker) and functions (example of drawing (B) scattered reflection nature) can be manufactured by performing concavo-convex processing of the lusterless section, a spherical-surface crevice, etc. to a plating field. Moreover, as shown in drawing 4 , the metallic foil which the part equivalent to the non-galvanizing section 57 penetrated can be continuously manufactured by forming the non-galvanizing section (the example of drawing hexagon section) 57 laid underground so that it might be exposed of an insulating material on a front face to the part so that the electrolytic deposition side of a plating coat may not be divided by the right angle to a hoop direction. In addition, detailed and exact processing is possible for the crevice under which the insulating material of the non-galvanizing section 57 is laid by precision processing of laser beam machining, etching processing, etc.
[0047] Moreover, although it supports free [rotation] to the side plate 31 of a pair before and after forming all the plating rollers 21 in a support plate 24, a support plate 24 is attached in the flexible column 25 and all the plating rollers 21 were pressed to the peripheral face of a rotating drum 1 by migration of the flexible column 25 with the above-mentioned operation gestalt, you may make it press the plating roller 21 to a rotating-drum 1 side for every group part opium poppy and group. If it does in this way, even when there are many plating rollers 21, adjustment of the thrust of each plating roller 21 will become easy.
[0048] Moreover, although the positive electrode member 29 of all the plating rollers 21 was connected electrically and the plating current was controlled by the above-mentioned operation gestalt to these whole, it may be made to control a plating current for the plating roller 21 for every group part opium poppy and group.
[0049] Moreover, although many injection nozzles 22 were formed in the plating liquid supply box 23, and the plating liquid supply means 20 was established with the above-mentioned operation gestalt so that plating liquid might be sprinkled on each plating roller 21 from these injection nozzles 22 As shown in drawing 5 , two or more plating liquid supply pipes 58 installed between every plating roller 21 and the adjoining plating roller 21 are formed. Two or more injection nozzles 22 to which it pointed on the plating roller 21 are installed successively to this plating liquid supply pipe 58, and you may make it sprinkle plating liquid on each plating roller 21 from the injection nozzle 22 of each plating liquid supply pipe 58. In this case, the control of flow of the plating liquid sprinkled on each plating roller 21 becomes easy by controlling the flow rate of the plating liquid supplied to each plating liquid supply pipe 58, and a pressure.
[0050] Moreover, what is necessary is just to form at least one plating roller with the above-mentioned operation gestalt, although two or more plating rollers 21 of a minor diameter were formed comparatively. In this case, it is desirable to adjust the peripheral speed of a rotating drum 1 so that may enlarge the outer diameter of a plating roller, and contact area with the peripheral face of a rotating drum 1 may be enlarged, and contact time amount of a plating roller and the peripheral face of a rotating drum 1 may be lengthened and the electrolytic deposition of a plating coat may be promoted. Moreover, although one liquid absorption roller 41 was respectively used with the above-mentioned operation gestalt as the plating liquid recovery means 3 and a penetrant remover recovery means 5, of course according to the size of a rotating drum 1 or the liquid absorption roller 41, the liquid absorption roller of a number may be attached suitably.
[0051] Moreover, as shown in drawing 6 , a metallic foil can be etched through the proper pattern section established by the masking tape 62 by attaching the etching means 61 to the downstream of the plating liquid washing means 4. The liquid end member 65 formed with the rubber plate etc. is attached to the upstream of said etching means 61, and the liquid end member 66, the etching-reagent washing means 67, and the penetrant remover removal means 68 are attached to the downstream of the etching means 61 in this sequence. Said etching means 61 was established between the presser-foot rollers 63 and 63 of a pair conveyed while sticking a masking tape 62 to the peripheral face of a rotating drum 1, and these presser-foot rollers 63 and 63, and is equipped with the etching-reagent supply pipe 64 which has the injection nozzle which injects an etching reagent to the peripheral face side of a rotating drum 1. It can convey sticking said masking tape 62 to the peripheral face of a rotating drum 1, it can let the pattern section established by the masking tape 62 pass by carrying out injection supply of the etching reagent towards a masking tape 62 from the etching-reagent supply pipe 64, and the metallic foil part exposed to this pattern section can be etched. In addition, in this drawing, the same sign shows the same member as drawing 1 R> 1, and the exfoliation roller 54 serves as the sticking-by-pressure roller.
[0052] Moreover, as shown in drawing 7 , continuation manufacture of the metallic foil by which desired printing was made can also be carried out by attaching the printing means 71 to the downstream of the desiccation means 6. Said printing means 71 contacts the metallic foil adhering to the peripheral face of a rotating drum 1 in the state of press, and is equipped with the printing roller 72 which prints on the front face, carrying out follower

rotation according to migration of a metallic foil, and the ink fixing assemblys 73, such as a heating heater formed if needed. Printing of the mask pattern for etching inhibition is included in this printing. In addition, like drawing 6 , in this drawing, the same sign shows the same member as drawing 1 , and the exfoliation roller 54 serves as the sticking-by-pressure roller.

[0053] Drawing 8 shows other operation gestalten of the manufacturing installation of the metallic foil of this invention, a same sign shows the same member as drawing 1 , and it omits the explanation. Plating means 2A is equipped with the plating liquid maintenance band 78 of the shape of a radii layer which contacts the peripheral face of a rotating drum 1 in the state of press sliding with this operation gestalt. Plating liquid supply means 20A which supplies plating liquid to the peripheral face of a rotating drum 1 through this plating liquid maintenance band 78, It has radii tabular positive electrode member 29A which countered the contact section of said plating liquid maintenance band 78 and peripheral face of a rotating drum 1, and has been arranged, and said plating liquid maintenance band 78 and positive electrode member 29A are supported by support plate 24A. Said plating liquid supply means 20A equips the upper part of said plating liquid maintenance band 78 with plating liquid supply pipe 39A which carried out opening, and plating liquid is supplied through said plating liquid supply pipe 39A through a closing motion valve and a flow control valve from the plating liquid hold tank which carried out the illustration abbreviation. Said support plate 24A is attached in the pressurization adjustment device (illustration abbreviation) through the flexible column 25, and the plating liquid maintenance band 78 is pressed by the peripheral face of a rotating drum 1 by the moderate pressure by telescopic motion of the flexible column 25. Said plating liquid maintenance band 78 is formed with the same ingredient as the plating liquid maintenance layer 28 which forms the periphery section of the plating roller 21 explained with the operation gestalt of drawing 1 . In addition, the plating liquid maintenance band 78 is equivalent to the plating liquid attachment component of this invention.

[0054] Moreover, plating liquid recovery means 3A and penetrant remover removal means 5A are equipped with absorptive layer 43A which contacted the peripheral face of a rotating drum 1, support plate 45A which supports this absorptive layer 43A, and recovery tubing 44A which was prepared in this support plate 45A, and was open for free passage to said absorptive layer 43A. Said absorptive layer 43A is formed with the same ingredient as said plating liquid maintenance band 78. The liquid end member which could use not only the thing of the example of drawing but the Ayr blow, and was formed with the rubber plate etc. as said penetrant remover removal means 5A may be used. In addition, the liquid absorption roller 41 used with the operation gestalt of drawing 1 can also be used as plating liquid recovery means 3A and penetrant remover removal means 5A.

[0055] The pressure which said plating liquid maintenance band 78 presses to the peripheral face of a rotating drum 1 is 10 - 100 g/cm2 like the operation gestalt of said drawing 1 . Extent is desirable. Moreover, it is good about the arrangement field as well as said operation gestalt to arrange along the hand of cut of a rotating drum 1 from the include angle of the direction upper limit of a vertical to 10 degrees or more so that plating liquid may not flow to the exfoliation means 7 side. Moreover, it is good for the bottom of the plating liquid maintenance band 78 to measure from the direction upper limit of a vertical of a rotating drum 1 to a hand of cut, and to arrange before about 135 degrees, and the topmost part of the plating liquid maintenance band 78 at least is better than the horizontal line (the inside of drawing 8 , H-H line) passing through the center of rotation of a rotating drum 1 to arrange up so that the plating liquid supplied to the plating liquid maintenance band 78 may permeate the peripheral face side of a rotating drum 1 promptly. Moreover, the plating liquid maintenance band 78 is good for the hoop direction of a rotating drum 1 also as block construction, and you may make it press it for every division part in this case. In addition, the feed hopper to the plating liquid maintenance band 78 of plating liquid supply pipe 39A is also better than the horizontal line passing through the center of rotation of a rotating drum 1 to prepare up so that plating liquid may be enough supplied to the topmost part of the plating liquid maintenance band 78. Moreover, said plating liquid supply pipe 39A may prepare two or more things to which a feed hopper is located in the upper part of the plating liquid maintenance band 78, and may prepare two or more things which have a feed hopper caudad from it further.

[0056] Moreover, although the example of drawing showed the radii tabular thing as said positive electrode member 29A, you may make it prepare a cylindrical electrode in the direction of a revolving shaft of a rotating drum 1, or a hoop direction two or more. You may connect in one electrically, and the group division of these may be carried out, and they may control a plating current for every group. Moreover, you may make it lay a positive electrode member underground into the plating liquid maintenance band 78.

[0057] Since the plating liquid maintenance band 78 carries out press sliding and rubs the peripheral face of a rotating drum also by this manufacturing installation in case electrolytic deposition of the metallic foil is carried out to the peripheral face of a rotating drum 1 by plating means 3A, the metallic foil of high quality without a defect is generable with a thin film. Moreover, since plating liquid is washed and the metallic foil which carried out electrolytic deposition to the peripheral face of a rotating drum 1 by plating means 3A is dried after that,

adhered to the peripheral face of a rotating drum 1, even if a metallic foil is a thin film, generating of a tear or a wrinkling is controlled.

[0058] In the manufacturing installation concerning this operation gestalt as well as the equipment of drawing 1 , as shown in drawing 3 , proper concavo-convex processing may be performed to the peripheral face of a rotating drum 1, and as shown in drawing 4 , it may form the non-galvanizing section. Moreover, the plating liquid supply pipe 58 shown in the plating liquid supply box 23 shown in drawing 1 or drawing 5 is formed between support plate 24A and the plating liquid maintenance band 78, and you may make it supply plating liquid to the plating liquid maintenance band 78 from these. Moreover, as shown in drawing 6 or drawing 7 , the etching means 61 and the printing means 71 may be attached.

[0059] Drawing 9 shows other operation gestalten of the manufacturing installation of the metallic foil of this invention, a same sign shows the same member as drawing 1 or drawing 8 , and it omits the explanation. With this operation gestalt, the internal magnet 82 is formed so that it may counter with said external magnet 81 into the external magnet 81 laid underground along the hoop direction of a rotating drum 1 into the plating liquid maintenance band 78 of plating liquid supply means 20A, and a rotating drum 1. Many holes are established by said external magnet 81, and the plating liquid supplied from plating liquid supply pipe 39A with this hole can permeate the peripheral face side of a rotating drum 1. Said internal magnet 82 is attached in the periphery section of the arm member 34 prepared in the ring section 83 prepared in the revolving shaft 13 free [rotation]. On the other hand, the balance weight 85 is attached in said ring section 83, and said internal magnet 82 is always held by this balance weight 85 irrespective of the existence of rotation of a rotating drum 1 in the external magnet 81 and the location where it counters. For this reason, between said external magnets 81 and internal magnets 82, a field with almost equal flux density is formed. In addition, said external magnet 81 and the internal magnet 82 grade constitute field means forming. Moreover, with the above-mentioned operation gestalt, although the external magnet 81 and the internal magnet 82 were used as a configuration member of field means forming, an electromagnet may be used instead of a permanent magnet.

[0060] If electrolytic deposition of the metallic foil which becomes the peripheral face of a rotating drum 1 from a ferromagnetic alloy is carried out where said field is formed, the metallic crystal which carries out electrolytic deposition in an operation of a field comes to turn to a specific direction, and the metallic foil which consists of a magnetic thin film of high quality can be manufactured continuously. In addition, that to which Co-P, Co-nickel, and a Co-nickel-P system alloy thin film added as [a magnetic drum a magnetic disk, a magnetic tape etc.] and to 80%nickel-20% Fe (permalloy presentation) and this, and coercive force added Co, Mo, P, etc. as an elasticity magnetic film below a number oersted is mainly used for the hard magnetic film of 100 or more oersteds for coercive force (Hc) as a storage element for computers.

[0061] Next, in the manufacturing installation of the metallic foil which showed this manufacturing installation to drawing 1 , although explained with reference to the whole block diagram having shown the operation gestalt of the manufacturing installation of the piece of a metallic foil of this invention in drawing 10 , since the exfoliation sections only differ, this agreement shows the same member as drawing 1 , and it omits that explanation.

[0062] With this operation gestalt, a fragmentation exfoliation means 91 to exfoliate dividing the metallic foil which carried out electrolytic deposition to the peripheral face of a rotating drum 1 in the shape of a scale is formed in the downstream of the desiccation means 6, and a recovery means 92 to collect further the pieces of a metallic foil by which fragmentation exfoliation was carried out with this fragmentation exfoliation means 91 is established.

[0063] As said fragmentation exfoliation means 91, by the example of drawing, the brush roller 93 is formed, and it is arranged free [rotation] so that the periphery point may contact the peripheral face of a rotating drum 1. Thin lines, such as an elasticity metal, for example, a pure copper, or a copper alloy, pure nickel, or a nickel alloy, and the gut and thin line which consist of hard or elasticity resin are densely implanted in the periphery section so that a crack may not be attached, even if said brush roller 93 contacts the peripheral face of a rotating drum 1.

[0064] Between said brush rollers 93 and plating means 2, the JIETO nozzle 94 which injects an air jet towards the peripheral face of the rotating drum 1 near the appearance side of said brush roller 93 is formed. Fragmentation exfoliation of a metallic foil is promoted and the inflow by the side of the plating means 2 of the piece of a metallic foil is prevented by the air jet injected from this jet nozzle 94.

[0065] Said recovery means 92 is equipped with the suction case 96 equipped with wrap covering for said brush roller 93 up to said jet-nozzle 94 neighborhood, and the inlet pipe 97 is connected to the back end section of this suction case 96.

[0066] Electrolytic deposition of the metallic foil is carried out to the peripheral face of a rotating drum 1, and it is made according to the manufacturing installation of this piece of a metallic foil, to rotate the brush roller 93 at a fragmentation exfoliation process, and to exfoliate, after drying, dividing the metallic foil adhering to the

peripheral face of a rotating drum 1. Under the present circumstances, the superficial size of the piece of a metallic foil which exfoliates in the shape of fragmentation can be easily adjusted by adjusting the rotational frequency of the brush roller 93. The thickness of the piece of a metallic foil is the thickness of the plating coat which carried out electrolytic deposition to the rotating drum 1, and is 0.1-10 micrometers at the manufacturing installation of this invention. It is easily controllable to extent. Moreover, the quality of the material of the piece of a metallic foil is the metal which can be galvanized, and it can be manufactured by any class. The piece of a metallic foil by which fragmentation exfoliation was carried out is attracted with air from the suction case 96, passes along an inlet pipe 97 by the recovery process, and is held in the container for recycling at it.

[0067] Although the brush roller 93 was used as a fragmentation exfoliation means 91 with the above-mentioned operation gestalt As a roller for fragmentation exfoliation, the buff roller which attached not only the brush roller 93 but the buff to the periphery section may be used. or -- for example, the periphery section formed by flexible material, such as silicone rubber and polyurethane rubber, -- having -- the peripheral face -- many lines -- gearing-like the roller with a slot with which the slot was formed in the direction of slant to the direction of a revolving shaft or the revolving shaft may be used. Moreover, you may make it also rotate the hand of cut of the roller for fragmentation exfoliation like the example of drawing not only to the rotation by the side of the desiccation means 6 but to the plating means 2 side. In this case, what is necessary is just to make peripheral speed of the roller for fragmentation exfoliation into a high speed from the peripheral speed of a rotating drum 1. The jet fuel injection equipment which injects the high-pressure air jet made to exfoliate further again, subtracting and breaking not only the roller for fragmentation exfoliation but a metallic foil from the peripheral face of a rotating drum 1 as a fragmentation exfoliation means may be used.

[0068] Moreover, it is (A) as it is shown in the plating field (electrolytic deposition side of a plating coat) of the peripheral face of a rotating drum 1 at drawing 11 , in order to control fragmentation size, while promoting fragmentation of a metallic foil, and exfoliation. It is (B) in parallel with the direction of slant to a drum hoop direction in parallel with a drum hoop direction. It is good to form much rill sections 98 in the shape of a slanting grid. The superficial size of the piece of a metallic foil is easily controllable by setting up suitably the magnitude of the flute width of the rill section 98, and arrangement spacing. Said rill section 98 may be cut with a knurling tool besides precision processing of laser beam machining, etching processing, etc. Although the rill section 98 may be formed in a groove since the plating coat was hard to be formed in the rill section 98, it is filled up with an insulating material into it, and is good also as the perfect non-galvanizing section. Moreover, of course also in this operation gestalt, it is good also as a configuration of the type shown in drawing 8 as the plating means 2, the plating liquid recovery means 3, and a penetrant remover removal means 5.

[0069] In addition, the piece of a metallic foil manufactured by the manufacturing installation of the piece of a metallic foil of this invention and the manufacture approach may be further made detailed with a ball mill etc. if needed. In this case, detailed-izing is easy for it in order just to make flat-surface size small, since thickness of the piece of a metallic foil is made thinly enough by this invention.

[0070] Although plating liquid is supplied to the metallic foil list concerning the operation gestalt shown in above-mentioned drawing 1 , drawing 8 , and the drawing 9 list at drawing 10 in the manufacturing installation of the piece of a metallic foil at the peripheral face of a rotating drum 1 through the plating roller 21 and the plating liquid maintenance band 78 which are a plating liquid attachment component, you may make it supply the peripheral face of a rotating drum 1 directly through a plating liquid attachment component from the plating liquid supply box 23 or the plating liquid supply pipe 58. By countering the peripheral face of a rotating drum 1 and carrying out contiguity arrangement of the radii tabular positive electrode member in this case, both can flow through between the peripheral face of a rotating drum 1, and positive electrode members through the flowing plating liquid, and electrolytic deposition of the metallic foil can be carried out to the peripheral face of a rotating drum 1. Moreover, only by preparing without making a plating liquid attachment component contact the peripheral face of a rotating drum 1 in the state of press contact, when preparing said plating liquid attachment component, so that it may only contact the plating liquid attachment component which can be made to carry out electrolytic deposition of the metallic foil to the peripheral face of a rotating drum 1 by small plating volume, and moreover contacts the peripheral face of a rotating drum 1 -- ****** of a rotating drum 1 -- it can prevent that it is washed continuously and a foreign matter is involved in the plating coat which carried out electrolytic deposition.

[0071]

[Example] Copper foil was continuously manufactured using the manufacturing installation of drawing 1 . A rotating drum 1 is a product made from titanium, and is 500mm in appearance phi500x width of face. Moreover, the plating rollers 21 are outer-diameter phi15x width of face (outside periphery width of face) of 400mm, and shaft diameter phi5mm, and covered the lead layer as a positive electrode member 29 in the periphery section of a revolving shaft. Moreover, the plating liquid maintenance layer 28 was formed with the nonwoven fabric which

consists of polypropylene. It is ten, and arranges from the upper limit of the direction of a vertical of a rotating drum 1 continuously in the range of 10 - 45 degrees to a hand of cut, and the used plating rollers 21 are an average of 50 g/cm2. It pressed to the peripheral face of a rotating drum 1 by the pressure. The shower of plating liquid (CuSO4 : 250 g/l, H2 SO4 :50 g/l, temperature: 30 degrees C) is sprayed by 1l. volume for /from on these ten plating rollers 21, rotational speed is adjusted so that the peripheral speed of a rotating drum 1 may become a part for 15cm/, and it is 10 A/dm2. It galvanized with current density.

[0072] The plating liquid which flowed out of the plating means 2 side into the downstream collected and reused the peripheral face of a rotating drum 1 with the liquid absorption roller 41 formed in the plating liquid recovery means 3. The used liquid absorption roller 41 is formed with the nonwoven fabric with which the absorptive layer 43 of the periphery section consists of polypropylene, and an outer diameter is phi100mm.

[0073] The copper foil which carried out electrolytic deposition to the peripheral face of a rotating drum 1 with the plating means 2 carried out shower rinsing with the plating liquid washing means 4, and after the liquid absorption roller 41 in which the wash water which remained on the front face was prepared by the penetrant remover removal means 5 removed most, it was dried at the far-infrared heater formed in the desiccation means 6.

[0074] As an exfoliation means 7, the cellulose system film which applied the water-soluble binder to the whole surface was used as the conveyance supporting material 52, and the exfoliation roller 54 which made the sticking-by-pressure roller serve a double purpose was used. The exfoliation roller 54 is what prepared the urethane sponge whose outer diameter is phi200mm in the periphery section, and is 100 g/cm2 to the peripheral face of a rotating drum 1. It pressed. As the adhesive layer of the conveyance supporting material 52 became the rotating-drum 1 side, it let the conveyance supporting material 52 pass in the contact section of the peripheral face of a rotating drum 1, and an exfoliation roller, while making the adhesive layer adhere to copper foil with a thickness of 2.8 micrometers which carried out electrolytic deposition to the peripheral face of a rotating drum 1, the conveyance supporting material 52 was moved along with the periphery according to rotation of the exfoliation roller 54, from the peripheral face of a rotating drum 1, it exfoliated continuously and copper foil was rolled round.

[0075] Then, a hot water shower is given to the conveyance supporting material which rolls a copper foil side almost as a roller peripheral face side, and wound it around the Teflon roller (outer-diameter phi500mm) with which Teflon (trade name) was covered by the peripheral face in the conveyance supporting material which adhered copper foil almost, and dissolution removal of a cellulose system film and the adhesive layer is carried out, and warm air is sprayed on the copper foil held at the roller peripheral face, and it dries, and is 2.8 micrometers. Continuation copper foil was obtained.

[0076] Copper foil was manufactured also by the conventional approach for the comparison. The equipment used for this manufacture is shown in drawing 12 , and is completely immersed in plating liquid in rotating-drum 105A as compared with the conventional equipment of drawing 13 . In addition, drawing 13 R> 3 and said division material attach this agreement.

[0077] Rotating-drum 105A is a drum made from titanium with an outer-diameter phi100x width of face of 200mm, and the peripheral face is processed on the mirror plane. Rotating this rotating-drum 105A by part for peripheral-speed/of 15cm, as the peripheral face (plating side) of rotating-drum 105A was hit in a part for 5l./in the jet of plating liquid, electrolytic deposition of the copper foil was carried out for current density to the peripheral face of rotating-drum 105A as 10 A/dm2, and plating time amount 2 minutes. After rinsing and drying, when it took out rotating-drum 105A from the plating bath tub 103 after plating, and copper foil was exfoliated from the peripheral face of rotating-drum 105A using said conveyance supporting material and conveyance supporting material was dissolved, it is 3.2 micrometers in thickness. Copper foil was obtained.

[0078] The copper foil manufactured by this invention was compared with the copper foil manufactured with the conventional method. Although uniform gloss was acquired at the rotating-drum peripheral face side of copper foil by what is depended on this invention when visual observation was carried out about the appearance, unevenness was in gloss in some which are depended on a conventional method. Moreover, in what is depended on this invention in the opposite side side (a plating means side or jet side of plating liquid), it was semigloss, and surface roughness was [what is depended on another side and a conventional method] also coarse mat. Moreover, although there was no defect what is depended on this invention in the rotating-drum peripheral face side of copper foil when optical microscope observation of the appearance was carried out by 400 times, in what is depended on a conventional method, the pit was accepted in some places. Moreover, although detailed crystal grain was accepted at the opposite side side by what is depended on this invention, it was based on the conventional method with the dent light-like crystal.

[0079] Moreover, although it was 0.8 kgf/mm tensile strength 2 and 32% of elongation in what is depended on this invention when the mechanical property was investigated, in what is depended on a conventional method, it

is tensile strength 0.1kgf / mm2, and 6% of elongation, and tensile strength and elongation are excellent in this invention.

[0080] Moreover, the thickness distribution of the die-length direction of the copper foil by this invention and the cross direction was investigated. The thickness of an end section [of the cross direction of a foil] (location separated from side edge about 40mm), center-section, and other end (location separated from other side edges about 40mm) per foil was measured by fluorescence-X-rays measurement by the position which met in the die-length direction on the basis of the location which separated the die length for 1 round of a rotating drum 1 from the manufacture initiation edge of copper foil. The measurement size of each point of measurement was set to 3, and asked for the average. The result is shown in Table 1. Table 1 shows having the quality in which the copper foil continuously manufactured by this invention has thickness with uniform die-length direction and cross direction, and the whole foil was stabilized, and the engine performance.

[0081]

[Table 1]

銅箔の厚さ単位(μm)		長さ方向位置(cm)						
		0	50	100	200	300	400	500
幅方向位置	一端部	2.76	2.79	2.77	2.81	2.74	2.74	2.81
	中央部	2.73	2.77	2.75	2.76	2.81	2.74	2.75
	他端部	2.78	2.80	2.75	2.82	2.80	2.79	2.76

[0082]

[Effect of the Invention] Since washing and desiccation are performed adhered to the peripheral face of a rotating drum, even when a metallic foil is a thin film, it is hard to produce damage among these processes, and the metallic foil which carried out electrolytic deposition to the peripheral face of a rotating drum can manufacture the metallic foil of high quality continuously and stably, and is excellent in productivity according to the manufacturing installation of the metallic foil of this invention, and the manufacture approach, as explained above. Moreover, since it is not necessary to form alone the plating bath tub, the mass washing station, and mass dryer which can hold a rotating drum, and to convey a metallic foil independently further in the case of washing and desiccation, the carrier facility of the difficult metallic foil of handling is also unnecessary, and a metallic foil can be continuously manufactured with easy equipment. Moreover, by carrying out electrolytic deposition of the metallic foil to the peripheral face of a rotating drum in the condition of having carried out press sliding and having rubbed to the peripheral face of a rotating drum, a plating liquid attachment component is quality and can manufacture continuously easily [a stabilization target] the metallic foil which moreover consists of a thin film. Moreover, according to the manufacturing installation of the piece of a metallic foil of this invention, and the manufacture approach, the metallic foil which employed the advantage of manufacture of the above-mentioned metallic foil efficiently can be manufactured, and only by exfoliating dividing this metallic foil in a final process, even if it is the case of a thin film, the piece of a metallic foil of homogeneity thickness can be manufactured continuously [in an easy manufacturing installation] and stably.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the whole manufacturing installation block diagram of the metallic foil concerning an operation gestalt.
[Drawing 2] It is an important section expanded sectional view in the A-A line of drawing 1 .
[Drawing 3] It is the expansion top view of the plating field of the peripheral face of a rotating drum, and is checker (A). And many spherical-surface crevices (B) The formed plating field is shown.
[Drawing 4] expansion top view (A) of the peripheral face of a rotating drum And B-B line sectional view (B) it is -- that by which the non-galvanizing section was formed in the plating field is shown.
[Drawing 5] It is the important section sectional view showing the other examples of the plating liquid spraying means to a plating roller.
[Drawing 6] The whole manufacturing installation block diagram of the metallic foil equipped with the etching means is shown.
[Drawing 7] The whole manufacturing installation block diagram of the metallic foil equipped with the printing means is shown.
[Drawing 8] The plating liquid attachment component in a plating means is the whole metallic foil manufacturing installation block diagram concerning other operation gestalten which are another gestalten.
[Drawing 9] It is the whole manufacturing installation block diagram of the metallic foil equipped with field means forming.
[Drawing 10] It is the whole manufacturing installation block diagram of the piece of a metallic foil concerning an operation gestalt.
[Drawing 11] It is the expansion top view of the peripheral face of a rotating drum, and is the example of plane configuration of the rill section for the promotion of fragmentation of a metallic foil, and flat-surface size control (A). (B) It is shown.
[Drawing 12] It is the whole manufacturing installation block diagram of the metallic foil used for manufacture of the conventional metallic foil in the example.
[Drawing 13] It is the whole manufacturing installation block diagram of the conventional metallic foil.
[Description of Notations]
1 Rotating Drum
2 2A Plating means
3 3A Plating liquid recovery means
4 Plating Liquid Washing Means
5 5A Penetrant remover removal means
6 Desiccation Means
7 Exfoliation Means
8 Recovery Means
20 20A Plating liquid supply means
21 Plating Roller (Plating Liquid Attachment Component)
28 Plating Liquid Maintenance Layer
29 29A Positive electrode member
52 Conveyance Supporting Material
53 Sticking-by-Pressure Roller
54 Exfoliation Roller (Migration Means)
57 Non-Galvanizing Section
78 Plating Liquid Maintenance Band (Plating Liquid Attachment Component)
81 External Magnet (Field Means Forming)

82 Internal Magnet (Field Means Forming)
91 Fragmentation Exfoliation Means
92 Recovery Means
93 Brush Roller
96 Suction Case

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（A）　(11)特許出願公開番号
特開2000－109993
（P2000－109993A）
(43)公開日　平成12年４月18日(2000.4.18)

(51)Int.Cl.'	識別記号	ＦＩ	ﾃｰﾏｺｰﾄﾞ（参考）
Ｃ２５Ｄ　1/04		Ｃ２５Ｄ　1/04	

審査請求　有　請求項の数15　ＯＬ　（全 16 頁）

(21)出願番号　特願平11－182777

(22)出願日　平成11年６月29日(1999.6.29)

(31)優先権主張番号　特願平10－218832
(32)優先日　平成10年８月３日(1998.8.3)
(33)優先権主張国　日本（ＪＰ）

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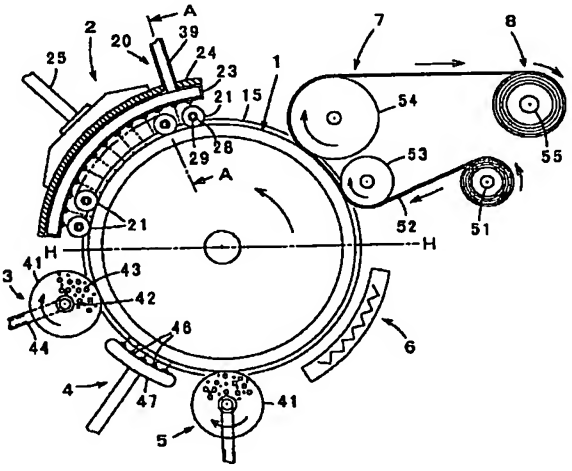
最終頁に続く

(54)【発明の名称】　金属箔、金属箔片の製造装置および製造方法

(57)【要約】
【課題】　金属箔が薄膜の場合であっても、金属箔、金属箔片を簡単な設備で連続的かつ安定的に製造することができる製造装置および製造方法を提供する。
【解決手段】　外周面が負電極面とされた回転ドラム１の外周面に当接するめっきローラ２１を介してめっき液を前記外周面に供給するめっき液供給手段２０と、めっき液を介して前記回転ドラム１の外周面と電気的に導通し前記回転ドラム１の外周面に金属箔を電解析出させる正電極部材２９とを備えためっき手段２を設ける。さらに、前記回転ドラム１の外周面に電解析出した金属箔に付着しためっき液を洗浄するめっき液洗浄手段４と、洗浄後の金属箔を乾燥する乾燥手段６と、乾燥後の金属箔を回転ドラム１の外周面から剥離する剥離手段７とを設ける。また、前記剥離手段７に代えて、金属箔を分断しつつ剥離するブラシローラを設けることで、金属箔片を製造することができる。



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【特許請求の範囲】

【請求項１】　回転自在に支持され、外周面が負電極面とされた回転ドラムと、

前記回転ドラムの外周面にめっき液を供給するめっき液供給手段と、該めっき液供給手段から供給されためっき液を介して前記回転ドラムの外周面と電気的に導通し前記回転ドラムの外周面に金属箔を電解析出させる正電極部材とを備えためっき手段と、

前記回転ドラムの回転方向に対して、前記めっき手段の下流側に設けられ、前記回転ドラムの外周面に電解析出した金属箔に付着しためっき液を洗浄するめっき液洗浄手段と、

前記回転ドラムの回転方向に対して、前記めっき液洗浄手段の下流側に設けられ、前記回転ドラムの外周面に電解析出した金属箔を乾燥する乾燥手段と、

前記回転ドラムの回転方向に対して、前記乾燥手段の下流側に設けられ、前記回転ドラムの外周面に電解析出した金属箔を前記外周面から剥離する剥離手段とを有する金属箔の製造装置。

【請求項２】　前記めっき液供給手段は前記回転ドラムの外周面に当接し、めっき液を保持しつつ前記回転ドラムの外周面に供給するめっき液保持部材を備えた請求項１に記載した金属箔の製造装置。

【請求項３】　前記めっき液保持部材は前記回転ドラムの回転に応じてその外周面に当接した状態で回転しながら、めっき液を保持しつつ前記回転ドラムの外周面に供給するめっき液保持層が外周部に設けられた１又は２以上のめっきローラにより構成される請求項２に記載の金属箔の製造装置。

【請求項４】　前記めっき液保持部材は前記回転ドラムの外周面に押圧摺動状態で当接する請求項２又は３に記載した金属箔の製造装置。

【請求項５】　前記めっき液保持部材の少なくとも一部は回転ドラムの回転中心を通る水平線よりも上方に配置された請求項２から４のいずれか１項に記載した金属箔の製造装置。

【請求項６】　前記回転ドラムは金属箔を電解析出させる外周面の一部に絶縁材が表面に露呈するように埋設された非めっき部が形成された請求項１から５のいずれか１項に記載した金属箔の製造装置。

【請求項７】　前記剥離手段は一方の面に粘着層が形成された搬送支持材と、該搬送支持材の粘着層を前記回転ドラムの外周面に電解析出した金属箔に押圧する圧着ローラと、金属箔が付着した搬送支持材を前記回転ドラムの径外方向に移動させる移動手段とを備える請求項１から６のいずれか１項に記載した金属箔の製造装置。

【請求項８】　回転自在に支持され、外周面が負電極面とされた回転ドラムと、

前記回転ドラムの外周面にめっき液を供給するめっき液供給手段と、該めっき液供給手段から供給されためっき液を介して前記回転ドラムの外周面と電気的に導通し前記回転ドラムの外周面に金属箔を電解析出させる正電極部材とを備えためっき手段と、

前記めっき手段によって前記回転ドラムの外周面に金属箔を電解析出させる領域に磁界を形成する磁界形成手段と、

前記回転ドラムの回転方向に対して、前記めっき手段の下流側に設けられ、前記回転ドラムの外周面に電解析出した金属箔に付着しためっき液を洗浄するめっき液洗浄手段と、

前記回転ドラムの回転方向に対して、前記めっき液洗浄手段の下流側に設けられ、前記回転ドラムの外周面に電解析出した金属箔を乾燥する乾燥手段と、

前記回転ドラムの回転方向に対して、前記乾燥手段の下流側に設けられ、前記回転ドラムの外周面に電解析出した金属箔を前記外周面から剥離する剥離手段とを有する金属箔の製造装置。

【請求項９】　前記めっき液供給手段は前記回転ドラムの外周面に押圧摺動状態で当接し、めっき液を保持しつつ前記回転ドラムの外周面に供給するめっき液保持部材を備えた請求項８に記載した金属箔の製造装置。

【請求項１０】　回転ドラムの外周面にめっき液を供給しつつ、負極とされた前記回転ドラムの外周面と正電極部材とを前記めっき液を介して通電し、前記回転ドラムの外周面に金属箔を電解析出させるめっき工程と、

前記回転ドラムの外周面に電解析出した金属箔に付着しためっき液を洗浄する洗浄工程と、

前記回転ドラムの外周面に電解析出した金属箔を洗浄後に乾燥する乾燥工程と、

前記回転ドラムの外周面に電解析出した金属箔を乾燥後に前記回転ドラムの外周面から剥離する剥離工程とを有する金属箔の製造方法。

【請求項１１】　前記回転ドラムの外周面に押圧摺動状態で当接し、めっき液を保持しつつ前記回転ドラムの外周面に供給するめっき液保持部材を設け、前記めっき工程は前記めっき液保持部材によって前記回転ドラムの外周面と前記めっき液保持部材との当接部にめっき液を供給しつつ、負極とされた前記回転ドラムの外周面と正電極部材とを前記めっき液を介して通電し、前記当接部に金属箔を電解析出させる請求項１０に記載した金属箔の製造方法。

【請求項１２】　前記剥離工程は搬送支持材の一方の面に形成された粘着層を前記回転ドラムの外周面に電解析出した金属箔に付着させ、金属箔が付着した搬送支持材を前記回転ドラムの径外方向に移動させることにより金属箔を前記回転ドラムの外周面から剥離する請求項１０又は１１に記載した金属箔の製造方法。

【請求項１３】　請求項１～５のいずれか１項に記載した回転ドラム、めっき手段、めっき液洗浄手段および乾燥手段を備え、同請求項に記載した剥離手段に代えて回

転ドラムの回転方向に対して、前記乾燥手段の下流側に設けられ、前記回転ドラムの外周面に電解析出した金属箔を前記外周面から分断しつつ剥離する分断剥離手段を設けた金属箔片の製造装置。

【請求項１４】前記回転ドラムは金属箔を電解析出させる外周面に多数の細溝部が形成された請求項１３に記載した金属箔片の製造装置。

【請求項１５】　請求項１０又は１１に記載しためっき工程、洗浄工程および乾燥工程を備え、同請求項に記載した剥離工程に代えて回転ドラムの外周面に電解析出した金属箔を乾燥後に前記回転ドラムの外周面から分断しつつ剥離する分断剥離工程を設けた金属箔片の製造方法。

【発明の詳細な説明】

【０００１】

【発明が属する技術分野】本発明は、銅箔、貴金属箔等の金属箔並びに金属箔を鱗片状に分断した金属箔片を連続的に製造することができる金属箔、金属箔片の製造装置および製造方法に関する。

【０００２】

【従来の技術】金属箔は電子部品、電極部品、触媒、その他各種部材の機能用あるいは装飾用素材として多方面で使用されている。従来、金属箔は圧延により製造されていたが、圧延による金属箔の厚さは３０μｍ程度が限度であり、また材質によっては、Ｍｏ系合金のように圧延が困難なものもある。近年、金属箔についても、コスト面、性能面等からより薄いものが要求されるようになっており、かかる要求に対して、電気めっきを利用した金属箔の製造装置、方法が提案されている。

【０００３】図１３は電気めっきを利用した金属箔の連続製造装置の一例を示しており、めっき浴１０１の浴面を規制する仕切り板１０２を備えためっき浴槽１０３と、めっき浴１０１中に上部が露出した状態で浸漬されるとともに回転自在に支持された回転ドラム１０５と、めっき浴１０１内で回転ドラム１０５の外周部に分割して配置された正電極部材１０６を備えている。前記回転ドラム１０５は正電極部材１０６に対して電気的に負電位とされ、その外周面は負電極面を構成している。また、めっき浴１０１中では回転ドラム１０５の外周部に設けられた複数の噴射ノズル１０７から回転ドラム１０５の外周面に向かってめっき液が均等に噴射されている。

【０００４】前記回転ドラム１０５を回転させながら、電極に通電すると、回転ドラム１０５の外周面に回転ドラム１０５の回転に従ってめっき皮膜が電解析出し、これが成長して所定厚さの金属箔１１０が形成される。回転ドラム１０５の上部には剥離ローラ１０８が付設されており、金属箔１１０は剥離ローラ１０８を介して回転ドラム１０５の外周面から剥離され、後工程の水洗工程、乾燥工程へと搬送され、巻き取られる。

【０００５】一方、鱗片状に偏平加工された金属粉末は、そのままの状態で美術工芸品の装飾素材として使用されたり、あるいは塗料に混合されて導電塗料やメタリック塗料等として使用される。このような鱗片状金属粉末としては、塗着性および特に貴金属では経済性の観点からできるだけ薄いものが要求される。

【０００６】従来、鱗片状金属粉末は、素材金属粉末をボールミルにより分断しつつ、鱗片状に偏平加工したり、貴金属の場合には素材金属を圧延によりできるだけ薄く引き延ばした後、さらに圧延された薄板をたたいて、より薄く引き延ばしつつ、微細片に分断させる加工方法が採られている。

【０００７】

【発明が解決しようとする課題】しかしながら、従来の電気めっきを利用した金属箔の製造装置、製造方法では、回転ドラムを収容する大きなめっき浴槽が必要であり、さらに回転ドラムから剥離した金属箔を後の水洗工程、乾燥工程に搬送するための搬送設備や、これらの処理工程を実施する水洗装置や乾燥装置が必要となり、装置構成が大型になり、引いては大きな設置スペースが必要で、設備コストも高くなるという問題がある。

【０００８】また、めっき種にもよるが、金属箔の剥離には２０μｍ程度の厚さが必要であり、１０μｍ程度になると剥離の際に破れたり、しわが寄ったりする。また、その後の水洗工程、乾燥工程においても、連続処理を行うには、金属箔に破れやしわが生じないように搬送設備を回転ドラムの回転と高精度に同期させることを要し、大がかりで高価な高精度搬送設備が必要になる。金属箔が薄膜になるほど、その取り扱いや工程間の移動がデリケートな作業となるため、この傾向は顕著になる。

【０００９】また、従来の金属箔の製造装置、製造方法では、回転ドラムの表面の酸化や不動態皮膜の形成のため、電解析出の初期においてめっき皮膜の析出が不安定で均一に析出し難く、特に数μｍ程度の薄膜では、めっき金属がデントライト状に電解析出し、外観が不均一となり、またピットや無数のピンホールが生じ、膜厚も不均一になりやすく、品質が劣化するという問題がある。

【００１０】一方、従来の鱗片状金属粉末の製造方法において、金属粉末を鱗片状に加工する方法では、金属粉末を製造するために溶融金属を噴霧化する等の大がかりな設備が必要である。また、圧延によって得られた薄板をたたき延ばす手法では、生産性に劣り、製造コストが高くなるという問題がある。また、金属箔を分断することで、鱗片状金属粉末と同等の金属箔片が得られるが、先に述べたように、比較的薄い金属箔を得ること自体が難しいため、薄膜状の金属箔片が得られにくいという問題がある。

【００１１】本発明はかかる問題に鑑みなされたもので、設置スペースが少なくてすみ、簡単な装置構成で薄膜状の金属箔を連続的に製造することができる金属箔の

製造装置および製造方法を提供するものである。また、金属箔が薄膜の場合においても、高品質の金属箔を簡単な設備で安定的に連続的に製造することができる金属箔の製造装置および製造方法を提供するものである。また、薄膜状の金属箔片を簡単な設備で安定的に連続的に製造することができる金属箔片の製造装置および製造方法を提供するものである。

【００１２】

【課題を解決するための手段】請求項１に記載した金属箔の製造装置は、回転自在に支持され、外周面が負電極面とされた回転ドラムと、前記回転ドラムの外周面にめっき液を供給するめっき液供給手段と該めっき液供給手段から供給されためっき液を介して前記回転ドラムの外周面と電気的に導通し前記回転ドラムの外周面に金属箔を電解析出させる正電極部材とを備えためっき手段と、前記回転ドラムの回転方向に対して、前記めっき手段の下流側に設けられ、前記回転ドラムの外周面に電解析出した金属箔に付着しためっき液を洗浄するめっき液洗浄手段と、前記回転ドラムの回転方向に対して、前記めっき液洗浄手段の下流側に設けられ、前記回転ドラムの外周面に電解析出した金属箔を乾燥する乾燥手段と、前記回転ドラムの回転方向に対して、前記乾燥手段の下流側に設けられ、前記回転ドラムの外周面に電解析出した金属箔を前記外周面から剥離する剥離手段とを有する。この製造装置によると、めっき手段によって回転ドラムの外周面に電解析出した金属箔は回転ドラムの外周面に付着したまま保持されるので、回転ドラムの回転に従って、めっき液洗浄手段によって洗浄され、乾燥手段によって乾燥される際に、たとえ金属箔が薄膜であっても、金属箔に破れやしわが生じにくく、高品質の金属箔を連続的かつ安定的に製造することができる。また、本発明の製造装置によると、従来必要とされた、回転ドラムの収容可能な大容量のめっき浴槽や、金属箔を洗浄工程や乾燥工程へ搬送する搬送設備や、洗浄設備および乾燥設備は不要であり、装置構成も回転ドラムの外周部にめっき手段等が付設されたものであるため、簡単で、設置スペースも少なくてすみ、設備コストも低廉ですむ。

【００１３】また、請求項２に記載した金属箔の製造装置は、請求項１に記載した製造装置において、前記めっき液供給手段は前記回転ドラムの外周面に当接し、めっき液を保持しつつ前記回転ドラムの外周面に供給するめっき液保持部材を備えたものである。この製造装置によると、回転ドラムの外周面とめっき液保持部材とは当接しており、めっき液はめっき液保持部材に保持されて存在するため、正電極部材はめっき液保持部材と接触するだけで回転ドラムの外周面に電気的に確実に導通するようになり、少ないめっき液量で安定的に電解析出を行うことができる。

【００１４】また、請求項３に記載した金属箔の製造装置は、請求項２に記載の製造装置において、前記めっき液保持部材は前記回転ドラムの回転に応じてその外周面に当接した状態で回転しながら、めっき液を保持しつつ前記回転ドラムの外周面に供給するめっき液保持層が外周部に設けられた１又は２以上のめっきローラにより構成されたものである。この製造装置によると、めっきローラの外周面と回転ドラムの外周面との当接部、好適には複数のめっきローラの当接部間にもめっき液が溜まりやすく、回転ドラムの回転に応じて回転ドラムの外周面に、めっき液をより安定的に供給することができ、めっき皮膜をより安定的に電解析出させることができる。また、めっきローラを交換することにより、めっき液保持部材を交換することができるため、メンテナンス性が良好である。

【００１５】また、請求項４に記載した金属箔の製造装置は、請求項２又は３に記載の製造装置において、前記めっき液保持部材は前記回転ドラムの外周面に押圧摺動状態で当接するように設けられたものである。この製造装置によると、金属箔をめっき手段により回転ドラムの外周面に電解析出させる際、めっき液保持部材が回転ドラムの外周面を押圧摺動して摩擦するため、前記回転ドラムの外周面がたえず洗浄され、電解析出しためっき皮膜に異物が巻き込まれるのを防止することができ、また電解析出するめっき皮膜の金属結晶組織が緻密になるため、薄膜でも欠陥のない高品質の金属箔を生成することができる。

【００１６】また、請求項５に記載した金属箔の製造装置は、請求項２から４のいずれか１項に記載の製造装置において、前記めっき液保持部材の少なくとも一部は回転ドラムの回転中心を通る水平線よりも上方に配置されたものである。この製造装置によると、回転ドラムの回転中心を通る水平線よりも上方に位置するめっき液保持部材の一部にめっき液を供給することにより、供給されためっき液は重力に逆らうことなくめっき液保持部材を介して回転ドラムの外周面側に流れやすくなり、めっき液保持部材と回転ドラムの外周面との当接部にめっき液をより安定的に供給することができ、めっき皮膜の安定的な電解析出を促進することができる。

【００１７】また、請求項６に記載した金属箔の製造装置は、請求項１から５のいずれか１項に記載の製造装置において、前記回転ドラムは金属箔を電解析出させる外周面の一部に絶縁材が表面に露呈するように埋設された非めっき部が形成されたものである。この製造装置によると、回転ドラムの外周面に形成された非めっき部にはめっき皮膜が電解析出されないため、非めっき部に対応した部分に穴が開いた金属箔、例えば基板パターンのような特定の平面形状を有する金属箔をプレス等による形状切断加工を行うことなく、連続的に製造することができる。

【００１８】また、請求項７に記載した金属箔の製造装置は、請求項１から６のいずれか１項に記載の製造装置

において、前記剥離手段は一方の面に粘着層が形成された搬送支持材と、該搬送支持材の粘着層を前記回転ドラムの外周面に電解析出した金属箔に押圧する圧着ローラと、金属箔が付着した搬送支持材を前記回転ドラムの径外方向に移動させる移動手段とを備えるものである。この製造装置によると、圧着ローラによって金属箔が付着された搬送支持材は移動手段により回転ドラムの径外方向に移動されるので、金属箔には剥離のための張力が直接作用することなく、搬送支持材の移動により金属箔は回転ドラムの外周面から容易に剥離される。このため、金属箔が薄膜の場合でも、回転ドラムの外周面から安定的に剥離することができる。また、剥離後の取り扱いについても、金属箔は搬送支持材に付着されているため、金属箔に外力を直接作用させることなく取り扱うことでき、薄膜の場合でも取り扱い性に優れ、取り扱いの際の損傷を有効に防止することができる。

【００１９】請求項８に記載した金属箔の製造装置は、回転自在に支持され、外周面が負電極面とされた回転ドラムと、前記回転ドラムの外周面にめっき液を供給するめっき液供給手段と該めっき液供給手段から供給されためっき液を介して前記回転ドラムの外周面と電気的に導通し前記回転ドラムの外周面に金属箔を電解析出させる正電極部材とを備えためっき手段と、前記めっき手段によって前記回転ドラムの外周面に金属箔を電解析出させる領域に磁界を形成する磁界形成手段と、前記回転ドラムの回転方向に対して、前記めっき手段の下流側に設けられ、前記回転ドラムの外周面に電解析出した金属箔に付着しためっき液を洗浄するめっき液洗浄手段と、前記回転ドラムの回転方向に対して、前記めっき液洗浄手段の下流側に設けられ、前記回転ドラムの外周面に電解析出した金属箔を乾燥する乾燥手段と、前記回転ドラムの回転方向に対して、前記乾燥手段の下流側に設けられ、前記回転ドラムの外周面に電解析出した金属箔を前記外周面から剥離する剥離手段とを有する。この製造装置によると、請求項１に記載した発明と同様、めっき手段によって回転ドラムの外周面に電解析出した金属箔は、回転ドラムの外周面に付着したまま保持されるため、回転ドラムの回転に従ってめっき液洗浄手段によって洗浄され、乾燥手段によって乾燥される際に、金属箔が薄膜であっても、破れやしわが生じにくく、高品質の金属箔を安定的に連続製造することができる。また、設備構成も簡単で、設置スペースも少なくてすむ。さらに、強磁性合金からなる金属箔を電解析出する際に磁界形成手段によって磁界を形成することにより、磁界の作用で電解析出する金属結晶が特定の方向を向くようになり、高品質の強磁性薄膜からなる金属箔すなわち磁気テープを連続的に低コストで製造することができる。

【００２０】また、請求項９に記載した金属箔の製造装置は、請求項８に記載の製造装置において、前記めっき液供給手段は前記回転ドラムの外周面に押圧摺動状態で当接し、めっき液を保持しつつ前記回転ドラムの外周面に供給するめっき液保持部材を備えたものである。この製造装置によると、金属箔をめっき手段により回転ドラムの外周面に電解析出させる際、正電極部材はめっき液保持部材と接触するだけで回転ドラムの外周面に電気的に確実に導通するようになり、少ないめっき液量で安定的に電解析出を行うことができる。さらに、電解析出の際、めっき液保持部材が回転ドラムの外周面を押圧摺動して摩擦するため、回転ドラムの外周面がたえず洗浄され、電解析出しためっき皮膜に異物が巻き込まれるのを防止することができ、また電解析出するめっき皮膜の金属結晶組織が緻密になるため、薄膜でも欠陥のない高品質の金属箔を生成することができる。

【００２１】請求項１０に記載した金属箔の製造方法は、回転ドラムの外周面にめっき液を供給しつつ、負極とされた前記回転ドラムの外周面と正電極部材とを前記めっき液を介して通電し、前記回転ドラムの外周面に金属箔を電解析出させるめっき工程と、前記回転ドラムの外周面に電解析出した金属箔に付着しためっき液を洗浄する洗浄工程と、前記回転ドラムの外周面に電解析出した金属箔を洗浄後に乾燥する乾燥工程と、前記回転ドラムの外周面に電解析出した金属箔を乾燥後に前記回転ドラムの外周面から剥離する剥離工程とを有する。この製造方法によると、めっき工程によって回転ドラムの外周面に電解析出した金属箔は、回転ドラムの外周面に付着したまま保持されるため、回転ドラムの回転に従ってめっき液洗浄工程によって洗浄され、乾燥工程によって乾燥される際に、金属箔が薄膜であっても、破れやしわが生じにくく、簡単な製造装置により高品質の金属箔を安定的に連続製造することができる。

【００２２】また、請求項１１に記載した金属箔の製造方法は、請求項１０に記載の製造方法において、前記回転ドラムの外周面に押圧摺動状態で当接し、めっき液を保持しつつ前記回転ドラムの外周面に供給するめっき液保持部材を設け、前記めっき工程は前記めっき液保持部材によって前記回転ドラムの外周面と前記めっき液保持部材との当接部にめっき液を供給しつつ、負極とされた前記回転ドラムの外周面と正電極部材とを前記めっき液を介して通電し、前記当接部に金属箔を電解析出させるものである。この製造方法によると、金属箔をめっき工程により回転ドラムの外周面に電解析出させる際、正電極部材はめっき液保持部材と接触するだけで回転ドラムの外周面に電気的に確実に導通するようになり、少ないめっき液量で安定的に電解析出を行うことができる。さらに、電解析出の際、めっき液保持部材が回転ドラムの外周面を押圧摺動して摩擦するため、回転ドラムの外周面がたえず洗浄され、電解析出しためっき皮膜に異物が巻き込まれるのを防止することができ、また電解析出するめっき皮膜の金属結晶組織が緻密になるため、薄膜でも欠陥のない高品質の金属箔を生成することができる。

【００２３】また、請求項１２に記載した金属箔の製造方法は、請求項１０又は１１に記載の製造方法において、前記剥離工程は搬送支持材の一方の面に形成された粘着層を前記回転ドラムの外周面に電解析出した金属箔に付着させ、金属箔が付着した搬送支持材を前記回転ドラムの径外方向に移動させることにより金属箔を前記回転ドラムの外周面から剥離するものである。この製造方法によると、搬送支持材に金属箔を付着させ、金属箔が付着した搬送支持材を回転ドラムの径外方向に移動させるため、金属箔には剥離のための張力が直接作用することなく、搬送支持材の移動により金属箔は回転ドラムの外周面から容易に剥離される。このため、金属箔が薄膜の場合でも、回転ドラムの外周面から安定的に剥離することができる。また、剥離後の取り扱いについても、金属箔は搬送支持材に付着されているため、金属箔に外力を直接作用させることなく取り扱うことでき、薄膜の場合でも取り扱い性に優れ、取り扱いの際の損傷を有効に防止することができる。

【００２４】請求項１３に記載した金属箔片の製造装置は、請求項１～５のいずれか１項に記載した回転ドラム、めっき手段、めっき液洗浄手段および乾燥手段を備え、同請求項に記載した剥離手段に代えて回転ドラムの回転方向に対して、前記乾燥手段の下流側に設けられ、前記回転ドラムの外周面に電解析出した金属箔を前記外周面から分断しつつ剥離する分断剥離手段を設けたものである。すなわち、本発明の金属箔片の製造装置は、下記(1)～(5)の金属箔片の製造装置を含むものである。

(1) 回転自在に支持され、外周面が負電極面とされた回転ドラムと、前記回転ドラムの外周面にめっき液を供給するめっき液供給手段と、該めっき液供給手段から供給されためっき液を介して前記回転ドラムの外周面と電気的に導通し前記回転ドラムの外周面に金属箔を電解析出させる正電極部材とを備えためっき手段と、前記回転ドラムの回転方向に対して、前記めっき手段の下流側に設けられ、前記回転ドラムの外周面に電解析出した金属箔に付着しためっき液を洗浄するめっき液洗浄手段と、前記回転ドラムの回転方向に対して、前記めっき液洗浄手段の下流側に設けられ、前記回転ドラムの外周面に電解析出した金属箔を乾燥する乾燥手段と、前記回転ドラムの回転方向に対して、前記乾燥手段の下流側に設けられ、前記回転ドラムの外周面に電解析出した金属箔を前記外周面から分断しつつ剥離する分断剥離手段を設けた金属箔片の製造装置。

(2) 前記めっき液供給手段は前記回転ドラムの外周面に当接し、めっき液を保持しつつ前記回転ドラムの外周面に供給するめっき液保持部材を備えた前記(1)に記載した金属箔片の製造装置。

(3) 前記めっき液保持部材は前記回転ドラムの回転に応じてその外周面に当接した状態で回転しながら、めっき液を保持しつつ前記回転ドラムの外周面に供給するめっき液保持層が外周部に設けられた１又は２以上のめっきローラにより構成される前記(2)に記載の金属箔片の製造装置。

(4) 前記めっき液保持部材は前記回転ドラムの外周面に押圧摺動状態で当接する前記(2)又は(3)に記載した金属箔片の製造装置。

(5) 前記めっき液保持部材の少なくとも一部は回転ドラムの回転中心を通る水平線よりも上方に配置された前記(2)から(4)のいずれか１項に記載した金属箔片の製造装置。

前記請求項１３に記載した金属箔片の製造装置によると、請求項１～５（前記(1)～(5)）に記載した発明の所定の構成に基づく既述の作用、効果を奏するほか、回転ドラムの外周面に形成された金属箔が分断剥離手段によって分断されながら剥離されるので、簡単な製造装置により薄膜の場合でも一定膜厚の金属箔片を連続的かつ安定的に簡単に製造することができる。

【００２５】また、請求項１４に記載した金属箔片の製造装置は、請求項１３に記載した金属箔片の製造装置において、前記回転ドラムは金属箔を電解析出させる外周面に多数の細溝部が形成されたものである。この金属箔片の製造装置によると、回転ドラムの外周面には多数の細溝部が形成されており、この細溝部は回転ドラムの外表面に比してめっきされにくいので、細溝部に対応した金属箔の部分は厚さが薄くなり、あるいは著しい場合には非めっき部となる。このため、この金属箔を分断剥離する際、金属箔を細溝部に沿って容易に細片に分断することができ、細溝部の溝幅、配置間隔を適宜設定することで、分断剥離される金属箔片の平面的サイズを容易に調整することができる。

【００２６】請求項１５に記載した金属箔片の製造方法は、請求項１０又は１１に記載しためっき工程、洗浄工程および乾燥工程を備え、同請求項に記載した剥離工程に代えて回転ドラムの外周面に電解析出した金属箔を乾燥後に前記回転ドラムの外周面から分断しつつ剥離する分断剥離工程を設けたものである。すなわち、本発明の金属箔片の製造方法は、下記(1)、(2)の金属箔片の製造装置を含むものである。

(1)　回転ドラムの外周面にめっき液を供給しつつ、負極とされた前記回転ドラムの外周面と正電極部材とを前記めっき液を介して通電し、前記回転ドラムの外周面に金属箔を電解析出させるめっき工程と、前記回転ドラムの外周面に電解析出した金属箔に付着しためっき液を洗浄する洗浄工程と、前記回転ドラムの外周面に電解析出した金属箔を洗浄後に乾燥する乾燥工程と、前記回転ドラムの外周面に電解析出した金属箔を乾燥後に前記回転ドラムの外周面から分断しつつ剥離する分断剥離工程とを有する金属箔片の製造方法。

(2) 前記回転ドラムの外周面に押圧摺動状態で当接し、めっき液を保持しつつ前記回転ドラムの外周面に供給す

るめっき液保持部材を設け、前記めっき工程は前記めっき液保持部材によって前記回転ドラムの外周面と前記めっき液保持部材との当接部にめっき液を供給しつつ、負極とされた前記回転ドラムの外周面と正電極部材とを前記めっき液を介して通電し、前記当接部に金属箔を電解析出させる前記(1)に記載した金属箔片の製造方法。

前記請求項１５に記載した金属箔片の製造装置によると、請求項１０および１１（前記(1)、(2)）に記載した発明の所定の工程に基づく既述の作用、効果を奏するほか、分断剥離工程により回転ドラムの外周面に形成された金属箔が分断されながら剥離されるので、簡単な製造装置により薄膜の場合でも一定膜厚の金属箔片を連続的かつ安定的に簡単に製造することができる。

【００２７】

【発明の実施の形態】図１は本発明の実施形態にかかる金属箔の製造装置の全体構成図を示しており、回転自在に支持された円筒状の回転ドラム１を備え、該回転ドラム１の回転方向に沿って、鉛直方向上端からめっき手段２、めっき液回収手段３、めっき液洗浄手段４、洗浄液除去手段５、乾燥手段６、剥離手段７が同順序で付設されている。

【００２８】前記回転ドラム１は、図２に示すように、円筒状外周部１１が左右一対の端板１２によって回転軸１３に取り付けられており、その外周面が鏡面に加工されて金属箔の電解析出面とされている。回転ドラム１の材質は、めっき液に対して耐食性があり、特に外周面は電解析出した金属箔が剥離しやすいように不動態皮膜を形成する材料、例えばステンレス鋼、チタンで形成される。回転ドラム１の全体をステンレス鋼で形成し、さらに外周部１１の外周面にクロムめっき層を形成してもよい。また、端板１２や回転軸１３をステンレス鋼で形成し、外周部１１のみをチタンで形成してもよい。また、回転ドラム１はめっき電源の負極に接続され、その外周面が負電極面とされる。

【００２９】前記めっき手段２は、回転ドラム１の外周部に周方向に並列して配置され、回転ドラム１の外周面に押圧摺動状態で当接する複数のめっきローラ２１を備え、該めっきローラを介して前記外周面にめっき液を供給するめっき液供給手段２０を有している。該めっき液供給手段２０は、各めっきローラ２１にめっき液を噴射ないし噴霧する複数の噴射ノズル２２が設けられためっき液供給ボックス２３を備えている。該めっき液供給ボックス２３にはめっき液供給管３９が接続され、図示省略しためっき液収容タンクから開閉弁および流量調整弁を介して前記めっき液供給管３９にめっき液が供給される。

【００３０】前記めっきローラ２１およびめっき液供給ボックス２３は支持板２４に支持され、前記支持板２４は図示省略した加圧調整機構によって駆動される伸縮コラム２５を介して取り付けられている。前記加圧調整機構としては、例えば流体圧シリンダ、モータシリンダ等を用いることができる。なお、前記支持板２４は、伸縮コラム２５を介することなく、加圧調整機構の伸縮部材（例えば、ピストンロッド）に直接取り付けるようにしてもよい。

【００３１】前記伸縮コラム２５の伸縮により、各めっきローラ２１は回転ドラム１の外周面に適度の圧力で押圧される。この圧力は１０～１００ｇ／㎠程度が好ましい。めっきローラ２１の回転を抑制する制動力にもよるが、圧力が弱過ぎるとめっきローラ２１の回転ドラム１の外周面に対する摺動による摩擦効果が過少となり、一方、圧力が高すぎると電解析出しためっき皮膜が除去されるようになる。また、回転ドラム１の外周面の両端部には、めっき液の流出防止用の液溜めリング１５が付設されており、この液溜めリング１５の内側に前記めっきローラ２１が嵌合状に設置されている。なお、前記めっきローラ２１は本発明のめっき液保持部材に相当するものである。

【００３２】前記めっきローラ２１は、図２に示すように、回転ドラム１の軸方向と平行に配置された回転軸２７を備え、その回りにめっき液を吸収排出自在に保持するめっき液保持層２８が設けられている。前記回転軸２７はめっき液に対して耐食性のある金属材、例えばステンレス鋼で形成されており、その外周部には鉛層からなる正電極部材２９が設けられている。前記めっき液保持層２８としては、めっき液に腐食されず、めっき液を毛細管現象により吸収排出自在に保持することができ、適度な弾力性を有する、例えば合成樹脂スポンジ、繊維や毛を束ねたもの、フェルト、不織布などを用いることができる。なお、前記回転軸２７および正電極部材２９は、銅めっきにより銅箔を製造する場合の構成であり、例えば貴金属箔を製造する場合には回転軸をチタンで形成し、正電極部材を白金層（例えばめっき皮膜）で形成すればよい。また、Ｎｉ箔を製造する場合は回転軸自体をＮｉで形成し、正電極部材を兼ねるようにすればよい。銅箔の場合も、回転軸自体を銅で形成し、正電極部材を兼ねるようにすることもできる。

【００３３】前記めっきローラ２１は、図２に示すように、回転軸２７の両端部が支持板２４の前端部および後端部に取り付けられた一対の側板３１に軸受３２を介して回転自在に支持されており、前記側板３１に設けられた制動機構３３によってめっきローラ２１の回転が制動される。制動機構３３は、複数のめっきローラ２１の回転軸２７の軸端上部に架設された摺動部材３４と、該摺動部材３４を各軸端側に付勢するスプリング３５と、該スプリング３５の上部を収容保持する保持部材３６と、該保持部材３６に取り付けられ、前記スプリング３５の弾発力を押さえ板を介して調整するねじ部材３７とで構成されている。回転ドラム１の外周面に押圧されためっきローラ２１は、回転ドラム１の回転により摩擦力によ

って従動回転するが、この際、前記制動機構３３によって回転軸２７に当接する摺動部材３４の押圧力を調整することで、回転軸２７と摺動部材３４との接触部に生じた摩擦力によりめっきローラ２１の回転が制動される。これにより、めっきローラ２１の外周部に設けられためっき液保持層２８は回転ドラム１の外周面上で押圧状態で摺動しながら回動する。前記摺動部材３４は各めっきローラ２１の回転軸２７に付設された正電極部材２９への給電ブラシとしても機能するものであり、各摺動部材３４は電気的に接続され、めっき電源の正極に接続される。

【００３４】前記めっきローラ２１は、回転ドラム１の回転方向に沿って、鉛直方向上端から１０度以上の角度から配置するのがよい。これにより、液切り部材を用いることなく、めっき液が剥離手段７側に流出するのを防止することができる。また、最下部のめっきローラ２１は回転ドラム１の鉛直方向上端から回転方向に測って１３５度程度までの間に配置するのがよく、少なくとも最上部のめっきローラ２１は回転ドラム１の回転中心を通る水平線（図１中、Ｈ－Ｈ線）より上方に配置するのがよい。また、該最上部のめっきローラ２１にめっき液が十分供給されるように、めっき液供給管３９のめっき液供給ボックス２３への接続口も回転ドラム１の回転中心を通る水平線よりも上方に設けるのがよい。これにより、最上部のめっきローラ２１に供給されためっき液は重力の作用を受けて回転ドラム１の外周面側に流動して外周面に沿って流れるようになり、回転ドラム１の外周面での電解析出が安定化する。なお、前記めっき液供給管３９は、めっき液供給ボックス２３の上部に接続されるものを複数本設けてもよく、さらにそれより下方に接続されるものを複数本設けてもよい。

【００３５】前記めっき液回収手段３は、回転ドラム１の外周面に当接して回転ドラム１の回転に従って従動回転する吸液ローラ４１を備えており、該吸液ローラ４１によりめっき手段２から排出され、回転ドラム１の外周面を伝わってきためっき液を吸収し、回収する。めっき液回収手段３は特に高コストの貴金属電解析出用めっき液を使用する場合には有効である。前記吸液ローラ４１は、回転自在に支持された回転軸４２の回りに前記めっき液保持層２８と同材質からなる吸液層４３が円筒状に付設されている。前記回転軸４２は多孔管で構成されており、軸端には真空ポンプ等の吸液装置に接続された回収管４４が取り付けられている。吸液ローラ４１はばね等の適宜の付勢手段により金属箔が剥離しない程度の圧力で回転ドラム１の外周面に当接しており、回転ドラム１の回転により従動回転しながら、吸液層４３が回転ドラム１の外周面を伝わって流れてきためっき液を吸収する。吸液層４３に吸収されためっき液は、回転軸４２、回収管４４を介して回収され、再利用される。

【００３６】前記めっき液洗浄手段４は、回転ドラム１の外周面に沿って配設された多数の噴射ノズル４６を備えた洗浄液供給管４７を備えており、回転ドラム１の外周面にめっき手段２によって電解析出した金属箔に付着しためっき液を噴射ノズル４６から回転ドラム１の外周面に向けて噴射した洗浄液で洗浄する。通常、洗浄液として水が使用される。

【００３７】前記めっき液洗浄手段４の下流側には、前記吸液ローラ４１と同様の構造を有する吸液ローラ４１を備えた洗浄液除去手段５が回転ドラム１の外周面に付設されており、回転ドラム１の外周面を伝わってくる洗浄後の洗浄液を吸い取り、除去して、金属箔の表面を乾燥されやすくしている。なお、洗浄液除去手段としては、前記吸液ローラ４１に限らず、例えばエアーブロー、ゴム板等で形成された液切り部材を用いてもよい。

【００３８】前記乾燥手段６は、金属箔の洗浄後、回転ドラム１の外周面に付着したまま金属箔を乾燥させるものであり、赤外線ヒータや温風送風機等が用いられる。なお、乾燥手段６は単なる送風機でもよく、必ずしも加熱乾燥を行うものであることを要しないが、赤外線ヒータ等の加熱乾燥機器を使用する場合、回転ドラム１の外周面に電解析出した金属箔を急速に加熱することができ、金属箔と回転ドラム１の外周部１１との熱膨張係数の違いに起因した熱膨張量の相違により、回転ドラム１の外周面から金属箔が剥離しやすくなる利点がある。

【００３９】前記剥離手段７は、巻戻し軸５１に送り出し自在に巻き取られ、一方の面に粘着層が形成された搬送支持材５２と、該搬送支持材５２が巻掛けられ、搬送支持材５２の粘着層を回転ドラム１の外周面に電解析出した金属箔に搬送支持材５２を介して押圧して付着させる圧着ローラ５３と、金属箔が付着した搬送支持材５２が巻掛けられ、これを回転ドラム１の径外方向に送り出すことにより金属箔を回転ドラム１から剥離する剥離ローラ５４とを備えている。

【００４０】前記圧着ローラ５３および剥離ローラ５４は、外周部がウレタンゴム、シリコンゴム、その他の合成ゴム、これらの発泡ゴム等の摩擦係数の比較的高い可撓性弾性材によって形成されており、回転ドラム１の外周面に搬送支持材５２を介して押圧状態で当接し、回転ドラム１の周速と同期して回転駆動されている。なお、前記剥離ローラ５４は本発明の移動手段に相当するものである。また、前記圧着ローラ５３を省略して、金属箔への粘着層の付着と、金属箔の剥離とを当該剥離ローラ５４のみで行うこともできる。

【００４１】前記剥離ローラ５４によって径外方向に送り出された搬送支持材５２は、これに付着した金属箔ごと回収手段８によって回収される。前記回収手段８としては、図例では、搬送支持材５２を巻取る巻取軸５５を備えた巻取装置が用いられているが、単に回収箱に収容するようにしてもよい。

【００４２】前記搬送支持材５２としては、樹脂テー

ブ、紙テープ、布テープ、金属テープなどが使用される。搬送支持材５２の材質は、金属箔の材質、厚さによって適宜選択されるが、特に金属箔の厚さが薄くなればなるほど、強度の高いものを使用するのがよく、簡単に伸び縮みするような材料は金属箔に損傷が生じ易くなるので好ましくない。なお、搬送支持材５２を支持材本体に離型剤が塗布された剥離テープとし、離型層の上に粘着層を形成することで、搬送支持材５２から粘着層が付着した金属箔を容易に剥離することができる。また、粘着層の付着のない金属箔を得るには、搬送支持材や粘着剤として水溶性のもの、例えばセルロース系のフィルムや粘着剤を使用し、これらを熱水により溶解除去すればよい。

【００４３】次に、上記製造装置を用いた金属箔の製造方法について説明する。金属箔を連続製造するには、まず、めっき工程によって回転ドラム１の外周面に金属箔を連続的に電解析出させる。すなわち、回転ドラム１を回転させ、めっき液供給手段２０からめっき液を定量供給し、回転ドラム１およびめっきローラ２１の正電極部材２９にめっき電圧を印加する。めっき液収容タンクから供給されためっき液は、めっき液供給ボックス２３、噴射ノズル２２を介してめっきローラ２１に噴射ないし噴霧され、めっきローラ２１の外周部に設けられためっき液保持層２８に毛細管現象により吸収保持されるとともに回転ドラム１の外周面に供給される。これによって、めっきローラ２１の回転軸２７に付設された正電極部材２９と回転ドラム１の外周面とが導通状態になり、回転ドラム１の外周面にめっき皮膜が電解析出する。めっき皮膜は次々にめっきローラ２１を通過する間に成長し、金属箔が連続的に生成する。めっき皮膜の電解析出の際には、めっきローラ２１の外周部に設けられためっき液保持層２８が回転ドラム１の外周面を押圧摺動し、摩擦するため、回転ドラム１の外周面がたえず洗浄され、電解析出しためっき皮膜への異物の巻き込みが防止され、また電解析出するめっき皮膜の金属結晶組織が緻密になるため、薄膜でも欠陥のない高品質、高性能の金属箔を生成することができる。

【００４４】前記めっき工程によって回転ドラム１の外周面に電解析出した金属箔は、次に、洗浄工程および乾燥工程によって、金属箔の表面に付着しためっき液が洗浄され、除去される。すなわち、回転ドラム１の回転に従って、めっき液洗浄手段４により洗浄され、洗浄液除去手段５により金属箔表面の洗浄液が概ね除去され、乾燥手段６により乾燥される。これらの一連の処理は、金属箔が回転ドラム１の外周面に付着したままの状態で行われるため、金属箔が薄膜であっても、破損、損傷が生じにくく、安定的に各処理を行うことができる。

【００４５】回転ドラム１の外周面に付着したまま乾燥された金属箔は、剥離工程によって回転ドラム１の表面から剥離され、回収工程にて回収される。すなわち、回転ドラム１の回転に従って、剥離手段７により、搬送支持材５２に支持された状態で連続的に剥離され、搬送支持材５２とともに巻取軸５５に巻き取られて回収される。この剥離の際、金属箔には剥離のための張力が直接作用しないため、金属箔が薄膜の場合でも回転ドラムの外周面から安定的に剥離することができる。また、剥離、回収後の取り扱いについても、金属箔は搬送支持材に付着されているため、金属箔に外力を直接作用させることなく取り扱うことでき、取り扱い性に優れる。

【００４６】上記実施形態では、回転ドラム１の外周面のめっき領域を平坦な鏡面に形成したが、図３に示すように、めっき領域に艶消し部や球面凹部等の凹凸加工を行うことにより、種々の模様（図例(A)では市松模様）や機能（図例(B)では乱反射性）を有する金属箔を製造することができる。また、図４に示すように、めっき皮膜の電解析出面が周方向に対して直角に分断されないように、その一部に絶縁材が表面に露呈するように埋設された非めっき部（図例では六角形部）５７を形成することで、非めっき部５７に相当する部分が貫通した金属箔を連続的に製造することができる。なお、非めっき部５７の絶縁材が埋設される凹部は、レーザ加工、エッチング加工等の精密加工により微細かつ正確な加工が可能である。

【００４７】また、上記実施形態では、全てのめっきローラ２１を支持板２４に設けた前後一対の側板３１に回転自在に支持し、支持板２４を伸縮コラム２５に取り付けて、伸縮コラム２５の移動により全てのめっきローラ２１を回転ドラム１の外周面に押圧するようにしたが、めっきローラ２１をグループ分けし、各グループ毎に回転ドラム１側に押圧するようにしてもよい。このようにすれば、めっきローラ２１の数が多い場合でも、各めっきローラ２１の押圧力の調整が容易になる。

【００４８】また、上記実施形態では、全てのめっきローラ２１の正電極部材２９を電気的に接続し、これらの全体に対してめっき電流の制御を行ったが、めっきローラ２１をグループ分けし、各グループ毎にめっき電流の制御を行うようにしてもよい。

【００４９】また、上記実施形態では、めっき液供給ボックス２３に多数の噴射ノズル２２を設け、これらの噴射ノズル２２から各めっきローラ２１にめっき液を散布するようにめっき液供給手段２０を設けたが、図５に示すように、めっきローラ２１ごとに、あるいは隣接するめっきローラ２１の間に並設されためっき液供給管５８を複数本設け、該めっき液供給管５８にめっきローラ２１に指向した複数の噴射ノズル２２を列設し、各めっき液供給管５８の噴射ノズル２２から各めっきローラ２１にめっき液を散布するようにしてもよい。この場合、各めっき液供給管５８に供給するめっき液の流量、圧力を制御することで、各めっきローラ２１に散布するめっき液の流量制御が容易になる。

【００５０】また、上記実施形態では、比較的小径のめっきローラ２１を複数個設けたが、少なくとも１個のめっきローラを設ければよい。この場合、めっきローラの外径を大きくして回転ドラム１の外周面との当接面積を大きくし、またはめっきローラと回転ドラム１の外周面との当接時間を長くし、めっき皮膜の電解析出を促進するように回転ドラム１の周速を調整することが好ましい。また、上記実施形態では、めっき液回収手段３、洗浄液回収手段５として、おのおの１個の吸液ローラ４１を使用したが、回転ドラム１や吸液ローラ４１のサイズに応じて、適宜数の吸液ローラを付設してもよいことは勿論である。

【００５１】また、図６に示すように、めっき液洗浄手段４の下流側にエッチング手段６１を付設することにより、マスキングテープ６２に開設された適宜のパタン部を通して金属箔をエッチングすることができる。前記エッチング手段６１の上流側にはゴム板等で形成された液切り部材６５が付設され、エッチング手段６１の下流側には、液切り部材６６、エッチング液洗浄手段６７、洗浄液除去手段６８がこの順序で付設されている。前記エッチング手段６１は、マスキングテープ６２を回転ドラム１の外周面に密着させながら搬送する一対の押さえローラ６３，６３と、該押さえローラ６３，６３の間に設けられ、回転ドラム１の外周面側にエッチング液を噴射する噴射ノズルを有するエッチング液供給管６４とを備えている。前記マスキングテープ６２を回転ドラム１の外周面に密着させながら搬送し、エッチング液供給管６４からマスキングテープ６２に向けてエッチング液を噴射供給することで、マスキングテープ６２に開設されたパタン部を通して、該パタン部に露出した金属箔部分をエッチングすることができる。なお、同図において、図１と同じ部材は同符号で示しており、剥離ローラ５４は圧着ローラを兼ねている。

【００５２】また、図７に示すように、乾燥手段６の下流側に印刷手段７１を付設することにより、所望の印刷がなされた金属箔を連続製造することもできる。前記印刷手段７１は、回転ドラム１の外周面に付着した金属箔に押圧状態で当接し、金属箔の移動に従って従動回転しつつその表面に印刷を行う印刷ローラ７２と、必要に応じて設けられる加熱ヒータ等のインキ定着器７３とを備える。この印刷には、エッチング阻止用のマスクパタンの印刷が含まれる。なお、図６と同様、同図において、図１と同じ部材は同符号で示しており、剥離ローラ５４は圧着ローラを兼ねている。

【００５３】図８は本発明の金属箔の製造装置の他の実施形態を示しており、図１と同じ部材は同符号で示し、その説明を省略する。この実施形態では、めっき手段２Ａは、回転ドラム１の外周面に押圧摺動状態で当接する円弧層状のめっき液保持帯７８を備え、該めっき液保持帯７８を介して回転ドラム１の外周面にめっき液を供給するめっき液供給手段２０Ａと、前記めっき液保持帯７８と回転ドラム１の外周面との当接部に対向して配置された円弧板状の正電極部材２９Ａとを有しており、前記めっき液保持帯７８および正電極部材２９Ａは支持板２４Ａに支持されている。前記めっき液供給手段２０Ａは前記めっき液保持帯７８の上部に開口しためっき液供給管３９Ａを備えており、図示省略しためっき液収容タンクから開閉弁および流量調整弁を介して前記めっき液供給管３９Ａを通してめっき液が供給される。前記支持板２４Ａは加圧調整機構（図示省略）に伸縮コラム２５を介して取り付けられており、伸縮コラム２５の伸縮により、めっき液保持帯７８は回転ドラム１の外周面に適度の圧力で押圧される。前記めっき液保持帯７８は、図１の実施形態で説明しためっきローラ２１の外周部を形成するめっき液保持層２８と同様の材料で形成されている。なお、めっき液保持帯７８は本発明のめっき液保持部材に相当するものである。

【００５４】また、めっき液回収手段３Ａおよび洗浄液除去手段５Ａは、回転ドラム１の外周面に当接した吸液層４３Ａと、該吸液層４３Ａを支持する支持板４５Ａと、該支持板４５Ａに設けられ、前記吸液層４３Ａに連通した回収管４４Ａとを備えている。前記吸液層４３Ａは、前記めっき液保持帯７８と同様の材料で形成されている。前記洗浄液除去手段５Ａとしては、図例のものに限らず、エアーブローを用いてもよく、また、ゴム板等で形成された液切り部材を用いてもよい。なお、めっき液回収手段３Ａおよび洗浄液除去手段５Ａとして、図１の実施形態で用いた吸液ローラ４１を用いることもできる。

【００５５】前記めっき液保持帯７８が回転ドラム１の外周面に押圧する圧力は、前記図１の実施形態と同様、１０～１００ｇ／cm²　程度が好ましい。また、その配置領域についても、前記実施形態と同様、めっき液が剥離手段７側に流れないように、回転ドラム１の回転方向に沿って、鉛直方向上端から１０度以上の角度から配置するのがよい。また、めっき液保持帯７８に供給されためっき液が回転ドラム１の外周面側に速やかに浸透するように、めっき液保持帯７８の最下部が回転ドラム１の鉛直方向上端から回転方向に測って１３５度程度までの間に配置するのがよく、少なくともめっき液保持帯７８の最上部は回転ドラム１の回転中心を通る水平線（図８中、Ｈ－Ｈ線）より上方に配置するのがよい。また、めっき液保持帯７８は回転ドラム１の周方向に分割構造としてもよく、この場合、各分割部分ごとに押圧するようにしてもよい。なお、めっき液保持帯７８の最上部にめっき液が十分供給されるように、めっき液供給管３９Ａのめっき液保持帯７８への供給口も回転ドラム１の回転中心を通る水平線よりも上方に設けるのがよい。また、前記めっき液供給管３９Ａは、供給口がめっき液保持帯７８の上部に位置するものを複数本設けてもよく、さら

にそれより下方に供給口を有するものを複数本設けてもよい。

【００５６】また、図例では前記正電極部材２９Ａとして円弧板状のものを示したが、棒状電極を回転ドラム１の回転軸方向に、あるいは周方向に複数本設けるようにしてもよい。これらは電気的に一体的に接続してもよく、またグループ分けして各グループ毎にめっき電流を制御してもよい。また、正電極部材は、めっき液保持帯７８の中に埋設するようにしてもよい。

【００５７】この製造装置によっても、金属箔をめっき手段３Ａにより回転ドラム１の外周面に電解析出させる際、めっき液保持帯７８が回転ドラムの外周面を押圧摺動して摩擦するため、薄膜でも欠陥のない高品質の金属箔を生成することができる。また、めっき手段３Ａによって回転ドラム１の外周面に電解析出した金属箔は、回転ドラム１の外周面に付着したまま、めっき液が洗浄され、その後乾燥されるため、金属箔が薄膜であっても、破れやしわの発生が抑制される。

【００５８】この実施形態にかかる製造装置の場合も、図１の装置と同様、図３に示すように回転ドラム１の外周面に適宜の凹凸加工を施してもよく、また図４に示すように非めっき部を形成してもよい。また、支持板２４Ａとめっき液保持帯７８との間に図１に示すめっき液供給ボックス２３や図５に示すめっき液供給管５８を設けて、これらからめっき液をめっき液保持帯７８に供給するようにしてもよい。また、図６や図７に示すようにエッチング手段６１や印刷手段７１を付設してもよい。

【００５９】図９は本発明の金属箔の製造装置の他の実施形態を示しており、図１あるいは図８と同じ部材は同符号で示し、その説明を省略する。この実施形態では、めっき液供給手段２０Ａのめっき液保持帯７８の中に回転ドラム１の周方向に沿って埋設された外部磁石８１と、回転ドラム１の中に前記外部磁石８１と対向するように内部磁石８２が設けられている。前記外部磁石８１には多数の孔が開設されており、この孔によってめっき液供給管３９Ａから供給されためっき液は回転ドラム１の外周面側に浸透することができる。前記内部磁石８２は、回転軸１３に回動自在に設けられたリング部８３に設けられたアーム部材３４の外周部に取り付けられている。一方、前記リング部８３にはバランスウエイト８５が取り付けられており、このバランスウエイト８５により、回転ドラム１の回転の有無にかかわらず、前記内部磁石８２が外部磁石８１と対向する位置に常に保持される。このため、前記外部磁石８１と内部磁石８２との間には磁束密度がほぼ等しい磁界が形成される。なお、前記外部磁石８１、内部磁石８２等は磁界形成手段を構成している。また、上記実施形態では、磁界形成手段の構成部材として外部磁石８１、内部磁石８２を用いたが、永久磁石の代わりに電磁石を用いてもよい。

【００６０】前記磁界が形成された状態で、回転ドラム１の外周面に強磁性合金からなる金属箔を電解析出すると、磁界の作用で電解析出する金属結晶が特定の方向を向くようになり、高品質の磁性薄膜からなる金属箔を連続的に製造することができる。なお、保磁力（Ｈｃ）が１００エルステッド以上の硬質磁性膜にはＣｏ－Ｐ、Ｃｏ－Ｎｉ、Ｃｏ－Ｎｉ－Ｐ系合金薄膜が磁気ドラム、磁気ディスク、磁気テープなどとして、また保磁力が数エルステッド以下の軟質磁性膜としては８０％Ｎｉ－２０％Ｆｅ（パーマロイ組成）およびこれにＣｏ、Ｍｏ、Ｐなどを添加したものが主に電子計算機用記憶素子として利用される。

【００６１】次に、本発明の金属箔片の製造装置の実施形態を、図１０に示した全体構成図を参照して説明するが、この製造装置は図１に示した金属箔の製造装置において、剥離部が異なるだけであるので、図１と同じ部材は同符合で示し、その説明を省略する。

【００６２】この実施形態では、乾燥手段６の下流側に、回転ドラム１の外周面に電解析出した金属箔を鱗片状に分断しつつ剥離する分断剥離手段９１が設けられ、さらに、この分断剥離手段９１によって分断剥離された金属箔片を回収する回収手段９２が設けられている。

【００６３】前記分断剥離手段９１として、図例ではブラシローラ９３が設けられており、その外周先端部が回転ドラム１の外周面に当接するように回転自在に配置されている。前記ブラシローラ９３は、回転ドラム１の外周面に接触しても疵が付かないように、軟質金属例えば純銅あるいは銅合金、純ニッケルあるいはニッケル合金等の細線や、硬質あるいは軟質樹脂からなるテグス、細線が外周部に密に植設されたものである。

【００６４】前記ブラシローラ９３とめっき手段２との間には、前記ブラシローラ９３の出側付近の回転ドラム１の外周面に向けてエアジェットを噴射するジェットノズル９４が設けられている。このジェットノズル９４から噴射されるエアジェットによって、金属箔の分断剥離が促進され、金属箔片のめっき手段２側への流入が防止される。

【００６５】前記回収手段９２は、前記ブラシローラ９３を前記ジェットノズル９４付近まで覆うカバーを備えた吸引ケース９６を備え、この吸引ケース９６の後端部には、吸気管９７が接続されている。

【００６６】この金属箔片の製造装置によると、回転ドラム１の外周面に金属箔を電解析出し、乾燥した後、分断剥離工程にて、ブラシローラ９３を回転させて、回転ドラム１の外周面に付着した金属箔を分断しつつ、剥離させる。この際、ブラシローラ９３の回転数を調整することで、分断状に剥離される金属箔片の平面的サイズを容易に調整することができる。金属箔片の厚さは、回転ドラム１に電解析出しためっき皮膜の厚さであり、本発明の製造装置では、０．１～１０μｍ程度に容易に制御することができる。また、金属箔片の材質も、めっきが

可能な金属であればいずれの種類でも製造可能である。分断剥離された金属箔片は、回収工程にて、吸引ケース９６から空気とともに吸引され、吸気管９７を通って、回収容器に収容される。

【００６７】上記実施形態では、分断剥離手段９１としては、ブラシローラ９３を用いたが、分断剥離用ローラとしては、ブラシローラ９３に限らず、例えば、バフを外周部に付設したバフローラでもよく、あるいは例えばシリコンゴム、ウレタンゴム等の可撓材で形成された外周部を備え、その外周面に多数の線状溝が回転軸方向あるいは回転軸に対して斜め方向に形成された歯車状の溝付きローラでもよい。また、分断剥離用ローラの回転方向も、図例のように乾燥手段６側への回転に限らず、めっき手段２側へ回転するようにしてもよい。この場合、分断剥離用ローラの周速は、回転ドラム１の周速より高速にすればよい。さらにまた、分断剥離手段としては、分断剥離用ローラに限らず、金属箔を回転ドラム１の外周面から引き破りながら剥離させる高圧エアジェットを噴射するジェット噴射装置を用いてもよい。

【００６８】また、金属箔の分断、剥離を促進すると共に分断サイズを制御するために、回転ドラム１の外周面のめっき領域（めっき皮膜の電解析出面）に、図１１に示すように、(A) ドラム周方向に平行に、あるいはドラム周方向に対して斜め方向に平行に、あるいは(B) 斜め格子状に多数の細溝部９８を形成しておくとよい。細溝部９８の溝幅の大きさ、配置間隔を適宜設定することで、金属箔片の平面的サイズを容易に制御することができる。前記細溝部９８は、レーザ加工、エッチング加工等の精密加工のほか、ローレットによって凹設してもよい。細溝部９８にはめっき皮膜が形成されにくいので、細溝部９８を溝状に形成したままでもよいが、その中に絶縁材を充填して、完全な非めっき部としてもよい。また、この実施形態においても、めっき手段２、めっき液回収手段３、洗浄液除去手段５として、図８に示したタイプの構成としてもよいことは勿論である。

【００６９】なお、本発明の金属箔片の製造装置、製造方法により製造された金属箔片は、必要に応じてさらにボールミル等により微細化してもよい。この場合、金属箔片の厚さは本発明により十分に薄くできるので、平面サイズを小さくするだけでよいため、微細化が容易である。

【００７０】上記図１、図８および図９並びに図１０に示した実施形態にかかる金属箔並びに金属箔片の製造装置においては、めっき液はめっき液保持部材であるめっきローラ２１やめっき液保持帯７８を介して回転ドラム１の外周面に供給されているが、めっき液保持部材を介することなく、めっき液供給ボックス２３やめっき液供給管５８から回転ドラム１の外周面に直接供給するようにしてもよい。この場合、例えば円弧板状の正電極部材を回転ドラム１の外周面に対向して近接配置することで、回転ドラム１の外周面と正電極部材との間を流れるめっき液を介して両者が導通し、回転ドラム１の外周面に金属箔を電解析出させることができる。また、前記めっき液保持部材を設ける場合においても、めっき液保持部材を押圧当接状態で回転ドラム１の外周面に当接させることなく、単に当接するように設けるだけで、少ないめっき液量で回転ドラム１の外周面に金属箔を電解析出させることができ、しかも回転ドラム１の外周面に当接するめっき液保持部材により、回転ドラム１の外周面たえず洗浄され、電解析出しためっき皮膜に異物が巻き込まれるのを防止することができる。

【００７１】

【実施例】図１の製造装置を用いて、銅箔を連続的に製造した。回転ドラム１はチタン製であり、外形φ５００×幅５００㎜である。また、めっきローラ２１は、外径φ１５×幅（外周部幅）４００㎜、軸径φ５㎜であり、回転軸の外周部には正電極部材２９として鉛層を被覆した。また、めっき液保持層２８はポリプロピレンからなる不織布で形成した。使用しためっきローラ２１は１０本で、回転ドラム１の鉛直方向の上端から回転方向に１０～４５度の範囲に連続的に配置し、平均５０ｇ／㎠の圧力で回転ドラム１の外周面に押圧した。これらの１０本のめっきローラ２１の上からめっき液（$CuSO_4$：２５０ｇ／ｌ、H_2SO_4：５０ｇ／ｌ、温度：３０℃）のシャワーを１ｌ／分の液量で噴霧し、回転ドラム１の周速が１５㎝／分となるように回転速度を調整し、１０Ａ／㏈ の電流密度でめっきを行った。

【００７２】回転ドラム１の外周面をめっき手段２側から下流側に流れ出たためっき液は、めっき液回収手段３に設けられた吸液ローラ４１にて回収し、再利用した。使用した吸液ローラ４１は、外周部の吸液層４３がポリプロピレンからなる不織布で形成されており、外径はφ１００㎜である。

【００７３】めっき手段２によって回転ドラム１の外周面に電解析出した銅箔は、めっき液洗浄手段４によってシャワー水洗し、表面に残留した洗浄水を洗浄液除去手段５に設けられた吸液ローラ４１によって大部分除去した後、乾燥手段６に設けられた遠赤外線ヒータにより乾燥した。

【００７４】剥離手段７として、一面に水溶性粘着剤を塗布したセルロース系フィルムを搬送支持材５２とし、圧着ローラを兼用した剥離ローラ５４を用いた。剥離ローラ５４は、外径がφ２００㎜のウレタンスポンジを外周部に設けたもので、回転ドラム１の外周面に１００ｇ／㎠　で押圧した。搬送支持材５２の粘着層が回転ドラム１側となるようにして、搬送支持材５２を回転ドラム１の外周面と剥離ローラとの当接部に通して、回転ドラム１の外周面に電解析出した厚さ２．８μmの銅箔に粘着層を付着させるとともに搬送支持材５２を剥離ローラ５４の回転に従ってその外周に沿って移動させて、銅

箔を回転ドラム１の外周面から連続的に剥離し、巻き取った。

【００７５】その後、銅箔を付着した搬送支持材を、テフロン（商品名）が外周面に被覆されたテフロンローラ（外径φ５００㎜）に銅箔側をローラ外周面側として巻き掛け、巻き掛けた搬送支持材に熱水シャワーを施してセルロース系フィルム、粘着層を溶解除去し、ローラ外周面に保持された銅箔に温風を吹き付けて乾燥し、２．８μｍの連続銅箔を得た。

【００７６】比較のため、従来の方法によっても銅箔を製造した。この製造に用いた装置は、図１２に示すものであり、図１３の従来装置に比して、回転ドラム１０５Ａをめっき液に完全に浸漬したものである。なお、図１３と同部材は同符合を付している。

【００７７】回転ドラム１０５Ａは、外径φ１００×幅２００㎜のチタン製ドラムであり、その外周面は鏡面に加工されている。この回転ドラム１０５Ａを周速１５cm／分で回転させながら、めっき液の噴流を５１／分で回転ドラム１０５Ａの外周面（めっき面）に当たるようにして、電流密度を１０Ａ／dm²、めっき時間２分として回転ドラム１０５Ａの外周面に銅箔を電解析出した。めっき後、回転ドラム１０５Ａをめっき浴槽１０３から取り出して、水洗、乾燥した後、前記搬送支持材を用いて回転ドラム１０５Ａの外周面から銅箔を剥離し、搬送支持材を溶解したところ、厚さ３．２μｍの銅箔が得られた。

【００７８】本発明によって製造した銅箔と従来法により製造した銅箔とを比較した。外観について目視観察したところ、銅箔の回転ドラム外周面側では、本発明によるものでは均一な光沢が得られたが、従来法によるものでは光沢にむらがあった。また、その反対面側（めっき手段側あるいはめっき液の噴流側）では、本発明によるものでは半光沢であり、他方、従来法によるものでは無光沢で表面粗度も粗いものであった。また、外観を４００倍で光学顕微鏡観察したところ、銅箔の回転ドラム外周面側では、本発明によるものでは欠陥が皆無であったが、従来法によるものでは所々にピットが認められた。また、その反対面側では、本発明によるものでは微細な結晶粒が認められたが、従来法によるものではデントライト状結晶となっていた。

【００７９】また、機械的性質を調べたところ、本発明によるものでは引張強さ０．８kgf／mm²、伸び３２％であったが、従来法によるものでは引張強さ０．１kgf／mm²、伸び６％であり、本発明では引張強さ、伸びともに優れている。

【００８０】また、本発明による銅箔の長さ方向、幅方向の厚さ分布を調べた。銅箔の製造開始端から回転ドラム１の１周分の長さを隔てた位置を基準にして、長さ方向に沿った所定の位置で、箔の幅方向の一端部（側端から約４０㎜隔てた位置）、中央部、他端部（他の側端から約４０㎜隔てた位置）につき箔の厚さを蛍光Ｘ線測定により測定した。各測定点のサンプル数は３とし、その平均を求めた。その結果を表１に示す。表１より、本発明によって連続的に製造した銅箔は、長さ方向、幅方向とも均一な厚さを有しており、箔全体が安定した品質、性能を有していることがわかる。

【００８１】

【表１】

銅箔の厚さ単位（μm）		長さ方向位置（cm）						
		0	50	100	200	300	400	500
幅方向位置	一端部	2.76	2.79	2.77	2.81	2.74	2.74	2.81
	中央部	2.73	2.77	2.75	2.76	2.81	2.74	2.75
	他端部	2.78	2.80	2.75	2.82	2.80	2.79	2.76

【００８２】

【発明の効果】以上説明したとおり、本発明の金属箔の製造装置、製造方法によれば、回転ドラムの外周面に電解析出した金属箔は、回転ドラムの外周面に付着したまま、洗浄、乾燥が行われるので、金属箔が薄膜の場合でも、これらの工程間で損傷が生じにくく、高品質の金属箔を連続的かつ安定的に製造することができ、生産性に優れる。また、回転ドラムの収容可能な大容量のめっき浴槽や、洗浄装置や乾燥装置を単体で設ける必要がなく、さらに洗浄、乾燥の際に金属箔を単独で搬送する必要がないので、取り扱いの困難な金属箔の搬送設備も不要であり、簡単な装置で金属箔を連続的に製造することができる。また、めっき液保持部材が回転ドラムの外周面に押圧摺動し、摩擦した状態で回転ドラムの外周面に金属箔を電解析出させることで、高品質で、しかも薄膜からなる金属箔を連続的かつ安定的に簡単に製造することができる。また、本発明の金属箔片の製造装置、製造方法によれば、上記金属箔の製造の利点を生かした金属箔を製造することができ、最終工程にてこの金属箔を分断しつつ剥離するだけで、薄膜の場合であっても、均一厚さの金属箔片を簡単な製造装置で連続的かつ安定的に製造することができる。

【図面の簡単な説明】

【図１】実施形態にかかる金属箔の製造装置の全体構成図である。

【図２】図１のＡ－Ａ線における要部拡大断面図である。

【図３】回転ドラムの外周面のめっき領域の展開平面図

であり、市松模様(A) および多数の球面凹部(B) が形成されためっき領域を示す。

【図４】回転ドラムの外周面の展開平面図(A) およびＢ－Ｂ線断面図(B) であり、めっき領域に非めっき部が形成されたものを示す。

【図５】めっきローラへのめっき液散布手段の他例を示す要部断面図である。

【図６】エッチング手段を備えた金属箔の製造装置の全体構成図を示す。

【図７】印刷手段を備えた金属箔の製造装置の全体構成図を示す。

【図８】めっき手段におけるめっき液保持部材が別形態である他の実施形態にかかる金属箔製造装置の全体構成図である。

【図９】磁界形成手段を備えた金属箔の製造装置の全体構成図である。

【図１０】実施形態にかかる金属箔片の製造装置の全体構成図である。

【図１１】回転ドラムの外周面の展開平面図であり、金属箔の分断促進、平面サイズ制御のための細溝部の平面配置例(A) 、(B) を示す。

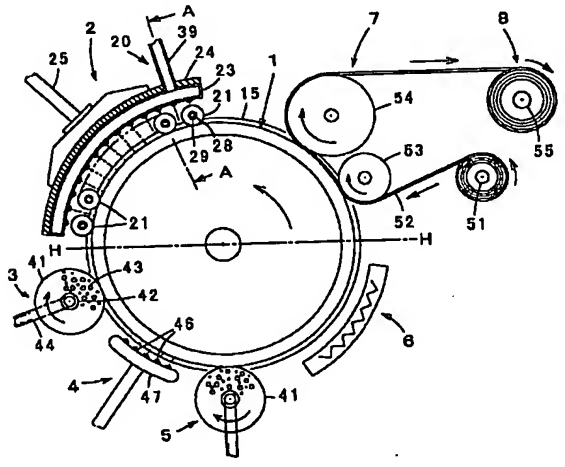
【図１２】実施例において従来の金属箔の製造に使用した金属箔の製造装置の全体構成図である。

【図１３】従来の金属箔の製造装置の全体構成図である。

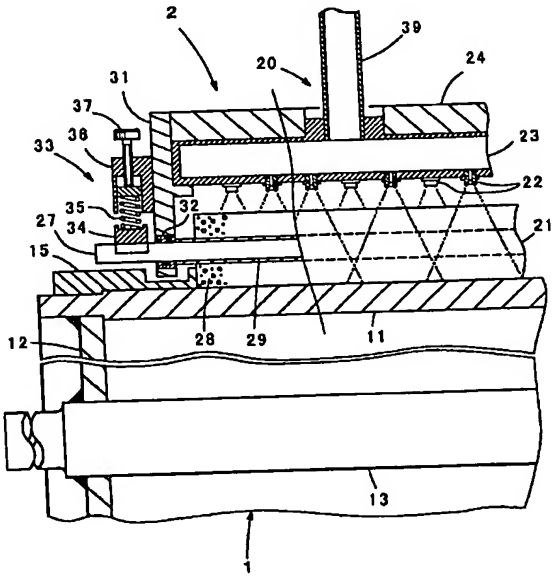
＊【符号の説明】

１　回転ドラム
２，２Ａ　めっき手段
３，３Ａ　めっき液回収手段
４　　めっき液洗浄手段
５，５Ａ　洗浄液除去手段
６　乾燥手段
７　剥離手段
８　回収手段
２０，２０Ａ　めっき液供給手段
２１　めっきローラ（めっき液保持部材）
２８　めっき液保持層
２９，２９Ａ　正電極部材
５２　搬送支持材
５３　圧着ローラ
５４　剥離ローラ（移動手段）
５７　非めっき部
７８　めっき液保持帯（めっき液保持部材）
８１　外部磁石（磁界形成手段）
８２　内部磁石（磁界形成手段）
９１　分断剥離手段
９２　回収手段
９３　ブラシローラ
９６　吸引ケース

【図１】

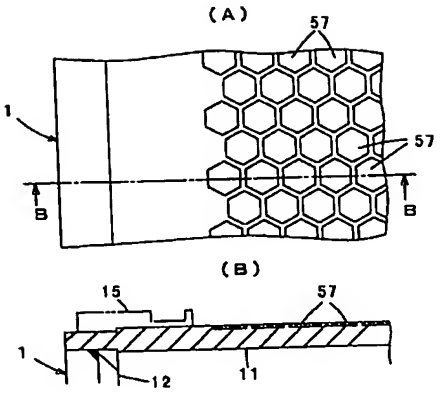


【図２】

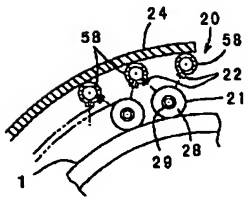


【図３】

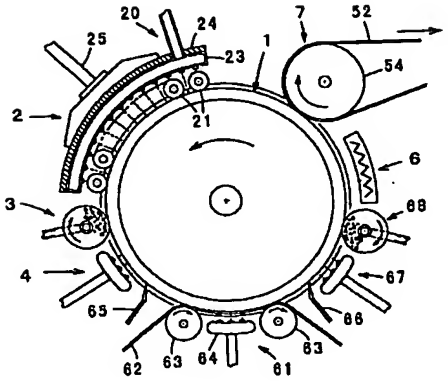
【図４】



【図５】



【図６】



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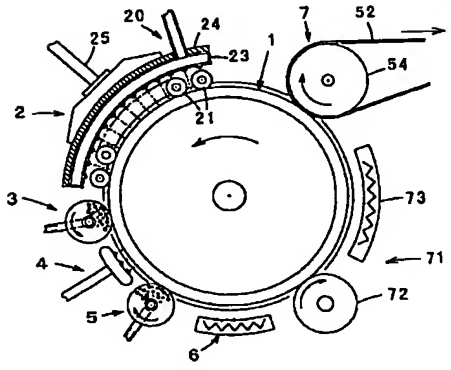

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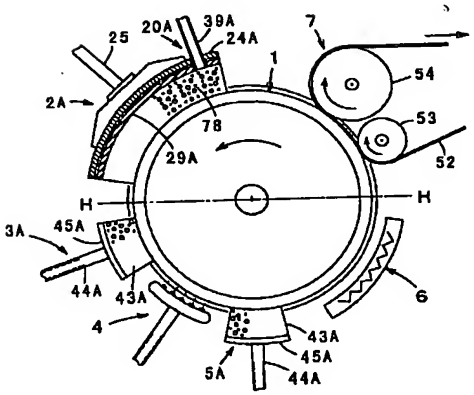
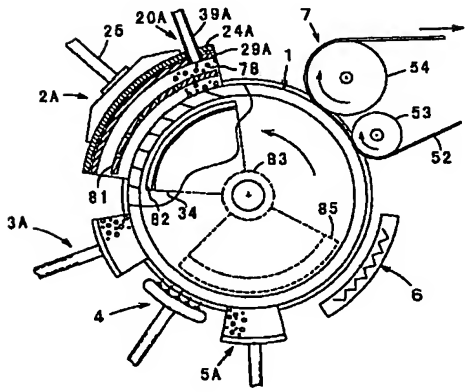
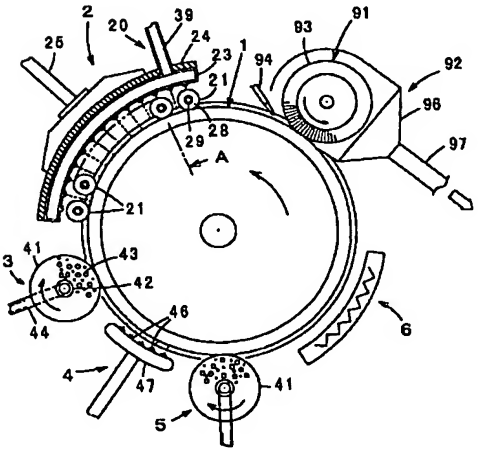


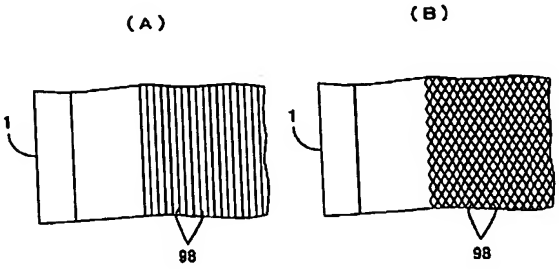
【図９】



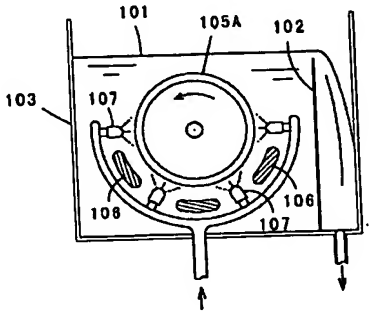
【図１０】



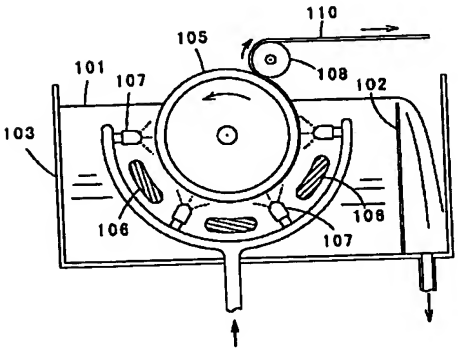
【図１１】



【図１２】



【図１３】



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